Project	AtlantOS – 633211
Deliverable number	D.10.5
Deliverable title	Best Practices in Stakeholder Engagement, Data Dissemination and Exploitation
Description	Identification of successful stakeholder engagement mechanisms and tools to make available, disseminate and visualize ocean observations/data serving as guidance to AtlantOS
Work Package number	WP10
Work Package title	Engagement, Dissemination and Communication
Lead beneficiary	Seascape Consultants
Lead authors	Belén Martín Míguez, Jan-Bart Calewaert, Oonagh McMeel
Contributors	(See Acknowledgements)
Submission data	30 September 2016
Due date	30 September 2016
Comments	

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 633211.

AtlantOS

AtlantOS: Optimising and Enhancing the Integrated Atlantic Ocean Observing Systems

Task 10.2, Deliverable 10.5

Best Practices in Stakeholder Engagement, Data Dissemination and Exploitation

September 2016

Lead parties for Deliverable: **Seascape Consultants**

Authors: **Belén Martín Míguez, Jan-Bart Calewaert, Oonagh McMeel**

Key words: **stakeholder engagement, ocean observatories, marine data portals**

Dissemination Level	
PU Public	X

Acknowledgements

The authors would like to express their most sincere gratitude to the participants both from within and beyond AtlantOS partnership, who took the AtlantOS Stakeholder Engagement survey and shared their time, experience and views with us.

The authors would also like to thank the following people who provided valuable input during the drafting of this deliverable: Frédérique Blanc, Claudia Cesarini, Vicente Fernández, Lluís Gómez-Pujol, Gus Jeans, Pedro Montero, Dick Schaap, Joaquín Tintoré, Begoña Vila and Karl Vilanova.

EXECUTIVE SUMMARY

The overarching objective of the AtlantOS Horizon 2020 project is to achieve the integration of the existing ocean observing activities in the Atlantic Ocean to build a sustainable, efficient and fit-for-purpose Integrated Atlantic Ocean Observing System. The success of this project will greatly depend on an adequate, fluid and fruitful engagement with stakeholders. The potential benefits are multiple: increasing project impact and relevance; facilitating the exploitation of data, products and services by users; obtaining endorsement and financial support, to name a few. All these potential outcomes will finally contribute to the sustainability of the future observing system.

The engagement process is a complex one. The main aim of Task 10.2 in AtlantOS is to gain a better understanding about how this process should be undertaken which could serve as guidance to AtlantOS. This deliverable "Best practices in Stakeholder Engagement, Data Dissemination and Exploitation" (D10.5) contributes to that aim by providing a comprehensive description of the engagement process, which is then adapted to take into consideration AtlantOS specificities. In this sense, particular attention will be paid to those processes involving users of ocean observatories, with a focus on marine data portals as key tools for engagement. The study undertaken in the framework of this task is largely based on desktop research, complemented by valuable input from contributors both from within and beyond the AtlantOS partnership obtained through various ways, including an online survey.

The deliverable first considers the engagement process as a whole, presenting the most fundamental concepts and introducing the vocabulary (Section 2). An important initial realisation is that the engagement process is very complex and can happen at different levels and moments, with different agents and through different mechanisms. The deliverable considers these elements in Section 3, defining and adapting them for the case of AtlantOS. This implies the need for a thorough mapping of the stakeholders and tools currently available to interact with them. It also requires taking into account when to use these tools and with which purpose. Relying on the improved knowledge of those elements, Section 4 proposes a sequence of steps to follow for a successful engagement process and offers a number of examples of stakeholder engagement in different ocean observatories presenting different characteristic, scopes and target users. These examples illustrate the wide variety of stakeholder engagement practices and help to identify innovative, original or particularly effective tools.

Amongst those tools, data portals outstand as a key tool to interact with stakeholders and as a gateway to disseminate, and facilitate the exploitation of data and other outputs from ocean observatories. For this reason, Section 5 reviews attributes relevant to describe the user-friendliness and usefulness of data portals serving ocean observing systems. A method is provided to categorize and assess these attributes, based on user experience. The main categories of attributes identified using this approach are: (i) visual impression (e.g. appeal, visual hierarchy); (ii) navigation (e.g. structure and simplicity, guidance); (iii) data availability (e.g. data access service, interoperability, data and pricing policy); (iv) data appropriateness (e.g. spatial/time extent and resolution); (v) interactive features of the portal (e.g. advanced plotting/mapping options, help and feedback features); (vi) specific attributes for ocean observatories (e.g. spread of data across measuring devices/platforms); and (vii) a set of 'other' attributes (e.g. social media, language options, etc.). The method can be used to identify key factors of success for data portals and ultimately evaluate their capacity to engage stakeholders over longer periods of time.

In Section 6, the most important findings of the deliverable are summarized, and some recommendations to be implemented during and beyond the lifetime of the AtlantOS project are suggested. Understanding the richness and complexity of the engagement process is a basic preliminary step for a successful interaction with stakeholders. The process is more successful when it is conceived in an interactive way, so that feedback from stakeholders can be considered and the system can evolve accordingly. This requires investing resources both to consider and analyse its main elements, and to develop and maintain communication channels that enable feedback. When resources are limited, priorities must be clearly established, target groups must be identified and their characteristics and needs must be well understood, so that engagement can be efficiently tailored to them. In terms of engagement through data portals and how they can best serve their users, the challenge is to take into account user requirements, which can vary greatly. Whilst this is complex, the previous considerations (a good knowledge of the user base and the implementation of measures to facilitate fruitful interaction) will help to translate this into concrete actions.

Finally, the insights, main findings and recommendations presented in this report not only provide guidance for the AtlantOS project's engagement practices, but also feed directly into AtlantOS Task 10.3. This task aims to investigate options to embed relevant engagement tools and practices into a durable stakeholder engagement support facility able to serve the needs of the envisaged Integrated Atlantic Ocean Observing System. Hence the first step of Task 10.3 should be to distil relevant aspects of D10.5 into a concept note with a few possible high level options for consideration on how AtlantOS and the envisaged observing system might engage with (private) stakeholders in future.

1 INTRODUCTION

1.1 Rationale

Stakeholders engagement is crucial for project success

The success of a project depends greatly on the adequate engagement of stakeholders, whether they are contributors or beneficiaries. Engaged, motivated contributors will develop a feeling of ownership towards the project and will work more efficiently towards the achievement of goals. In turn, involved, satisfied beneficiaries, will provide feedback and guide the correct development of the project to better fulfil their needs, giving reasons to support its continuation.

Before continuing, it will be helpful to clarify the scope of the AtlantOS project. AtlantOS is a H2020 project with concrete tasks to be developed between April 2015 – June 2019. In spite of this limited four year-timeframe, its ambition is a long-term one: to support the building of an Integrated Atlantic Ocean Observing System that will be sustainable in the future (see project summary below). The present deliverable will keep that long-term perspective in mind and in the following, reference to the AtlantOS project will also imply the future observing system that should result from it.

Project summary of AtlantOS
The overarching objective of AtlantOS is to achieve a transition from a loosely-coordinated set of existing ocean observing activities to a sustainable, efficient, and fit-for-purpose Integrated Atlantic Ocean Observing System (IAOOS), by defining requirements and systems design, improving the readiness of observing networks and data systems, and engaging stakeholders around the Atlantic; and leaving a legacy and strengthened contribution to the Global Ocean Observing System (GOOS) and the Global Earth Observation System of Systems (GEOSS). AtlantOS will fill existing in-situ observing system gaps and will ensure that data are readily accessible and useable. AtlantOS will demonstrate the utility of integrating in-situ and Earth observing satellite based observations towards informing a wide range of sectors using the Copernicus Marine Monitoring Services and the European Marine Observation and Data Network and connect them with similar activities around the Atlantic. AtlantOS will support activities to share, integrate and standardize in-situ observations, reduce the cost by network optimization and deployment of new technologies, and increase the competitiveness of European industries, and particularly of the small and medium enterprises of the marine sector. AtlantOS will promote innovation, documentation and exploitation of innovative observing systems. All AtlantOS work packages will strengthen the trans-Atlantic collaboration, through close interaction with partner institutions from Canada, United States, and the South Atlantic region. AtlantOS will develop a results-oriented dialogue with key stakeholders communities to enable a meaningful exchange between the products and services that IAOOS can deliver and the demands and needs of the stakeholder communities. Finally, AtlantOS will establish a structured dialogue with funding bodies, including the European Commission, USA, Canada and other countries to ensure sustainability and adequate growth of IAOOS.

Box 1. Project summary of AtlantOS project as described in the Grant Agreement.[1]

[1] AtlantOS Grant Agreement n° 633211 – AtlantOS – H2020-BG-2014-2015/H2020-BG-2014-2

AtlantOS recognizes the importance of stakeholder engagement

Stakeholder engagement in a project should not be taken for granted: it must be considered from the onset of the project and throughout. AtlantOS recognizes this: the project is designed to take stakeholders perspectives on board in order to make the system as useful and fit-for-purpose as possible, hence, contributing to its sustainability. For that reason, an Engagement Strategy has been devised within the framework of Work Package 10 ("Engagement, Dissemination and Communication") that has resulted in the Deliverable D10.1 ("Engagement Strategy"[2]). The objective of the Engagement Strategy is "*to offer a framework for engaging and communicating with stakeholders both during and after the project's lifetime in support of an Integrated Atlantic Observing System*".

The AtlantOS Grant Agreement specifically mentions the creation of an Engagement Board and its role towards "*bringing forth new ideas and concepts for engaging with stakeholders, attracting more users and bridging the gap between society and research*" (page 44 of the Description of the action of the AtlantOS Grant Agreement, part B). The composition of the Engagement Board will reflect the importance of certain communities -including industry and public bodies- as providers of ideas and concepts and the Engagement Strategy stresses the importance of engaging them at an early state.

The AtlantOS Engagement Strategy also describes other planned actions to be developed within the different Work Packages which require the involvement of external stakeholders. For instance, Work Package 8 aims at delivering a suite of end-user products for specific issues of societal concern. Engagement and consultation with those end-users to achieve an optimal product design is envisioned as part of the Work Package 8 activities. Work Package 7 in AtlantOS will be looking at improving the data flow to the ocean science community and other stakeholders. Part of this improvement will derive from a better data visualization and exploitation through existing data infrastructures such as Data Portals. In that respect, Section 5 of this deliverable will address specifically the issue of Data Portals as a way to attract and engage with users of ocean observatories.

Finally, the Engagement Strategy also specifies that "*For AtlantOS partners, the strategy will serve to create a clear and common understanding of how the relationship with stakeholders can be developed, as well as to provide an informal overview of engagement/communication tools that they can use in that process*".

AtlantOS can benefit from previous experiences

Engaging with stakeholders is recognized as a relevant and transversal process in AtlantOS, a process that must be considered from the beginning of the project, and also planned in advance. Ocean observing communities/systems have been operating for decades, engaging with stakeholders in many different ways depending on their own characteristics and capabilities, and also depending on their stakeholders' needs.

These diverse experiences have usually taken place on an *ad hoc* basis, and they are not always systematically reported and documented. Nevertheless, there is an increasing awareness around the subject and even if scattered and of very heterogeneous nature, it is still possible to find examples and references on the web pages of the observing systems or in dissemination materials produced by them. Many broader-ranging observatories and larger scale observation 'systems' have conceived

[2] https://www.atlantos-h2020.eu/download/deliverables/10.1%20Engagement%20Strategy.pdf

and implemented engagement strategies and these can often be found in publicly available strategic documents (e.g. the US IOOS Summit Report[3] or the IMOS-Australian Integrated Marine Observing System Strategic Plan[4]).

The present deliverable D10.5 on "Best Practices in Stakeholder Engagement, Data Dissemination and Exploitation" will provide an overview of these experiences which AtlantOS can use as a source of inspiration to further develop and refine its own engagement strategy and to stablish follow-up actions both during and beyond the lifetime of the project.

1.2 Aim and Objectives of the deliverable

The overall aim of Task 10.2 is to gain a better understanding on how to efficiently engage with stakeholders, attract more users and identify ways to improve usage of data and information from observatories. The deliverable resulting from this task (Deliverable D10.5) will contribute to that aim through the accomplishment of the following objectives.

- Provide an overview on the stakeholder engagement process and its main elements (Sections 2 and 3)
- Identify and describe those elements for the case of AtlantOS and the future Integrated Atlantic Ocean Observing System (Section 3)
- Examine approaches and tools used by ocean observing communities/systems to engage with their stakeholders and more in particular with users of their outputs: data, metadata, derived data-products and other services (Section 4)
- Examine the attributes that make Marine Data Portals engaging, as they are the core mechanism through which observatories can provide outputs to users (Section 5)
- Based on the previous assessments, provide a summary of key messages and recommendations to be considered by AtlantOS (Section 6)

1.3 Approach, contents and sections of this deliverable

To achieve the objectives of this deliverable (D10.5), a rigorous desk research study was undertaken to gather information already available from many different sources (printed, internet, personal communications) and scopes (general references, scientific papers, conference proceedings, projects reports). In particular, a considerable amount of time was devoted to visiting a large number of data portals serving ocean observatories from all over the world. Documents providing general overviews on stakeholder engagement processes were consulted in a first instance, but also reports where this was adapted to scientific projects were considered and concrete examples in the marine realm were identified. Deliverable D10.5 has greatly benefited from this landscaping exercise and reference is made to much of the consulted literature on stakeholder engagement practices, following their methodologies and incorporating their findings. In particular, extensive use has been made of the BiodivERsA stakeholder engagement handbook[5], which presents a number of best practice guidelines

[3] U.S. IOOS Summit Report: A New Decade for the Integrated Ocean Observing System (2013). Interagency Ocean Observation Committee. http://www.iooc.us/wp-content/uploads/2013/01/U.S.-IOOS-Summit-Report.pdf
[4] IMOS Strategy 2015-2025 (2014). http://imos.org.au/fileadmin/user_upload/shared/IMOS%20General/documents/IMOS/Plans___Reports/IMOS_Strategic_Plan_3Jun2014_low_res.pdf
[5] BiodivERsA Stakeholder Engagement Handbook. http:///www.biodiversa.org/577

for stakeholder engagement in research projects, and of the US Integrated Ocean Observing System (US IOOS)[6] summit report. The latter report and references therein are particularly suited to serve as example for the AtlantOS case. The consulted sources are referenced as footnotes for further information and a complete list is provided at the end of this deliverable.

The deliverable is as comprehensive as possible in its scope in order to achieve a thorough understanding of what engaging with stakeholders means and implies, regardless of the type of project. However the aim was also to provide concrete insights that can be useful for AtlantOS. Hence, whenever possible the deliverable has been tailored towards the project's needs taking into account that AtlantOS is primarily a scientifically-driven project, built around a number of already-existing ocean observing initiatives and networks. That AtlantOS should lead to the integration of all those initiatives into a sustainable observing system, a system capable of meeting the needs of the stakeholder communities, is also a chief consideration. Finally, in terms of the diversity of possible stakeholders, most attention has been paid to those who will be users of AtlantOS outputs.

Engaging with stakeholders is a very broad concept encompassing many different types of possible interactions. In this respect, and in the framework of ocean observatories, interactions related to the dissemination and exploitation of data acquire particular importance. For this reason the deliverable will focus on data portals as the 'virtual' place where those interactions primarily occur. Particular attention has been paid to the whole experience of someone using a marine data portal, to try and identify key factors of success in terms of user satisfaction and experience to establish a long term engaging relationship. A number of attributes are proposed to describe that experience, from the visual and navigational elements (friendliness) to those related to the data availability and appropriateness (usefulness). These attributes could potentially be used to assess the engagement capacity of marine data portals.

Finally, a survey was designed to learn about the consortium experience in engaging with stakeholders and to get views on how this should proceed in AtlantOS (see Section 1.4 and for a more detailed description). The stakeholder engagement survey provides valuable insights that will complement the desktop study results presented in Sections 3, 4 and 5 of the deliverable.

[6] U.S. IOOS Summit Report: A New Decade for the Integrated Ocean Observing System. 2013 Interagency Ocean Observation Committee. http://www.iooc.us/wp-content/uploads/2013/01/U.S.-IOOS-Summit-Report.pdf

The approach, contents and sections of the deliverable are shown in relation to each other in the figure below (*Figure 1)*:

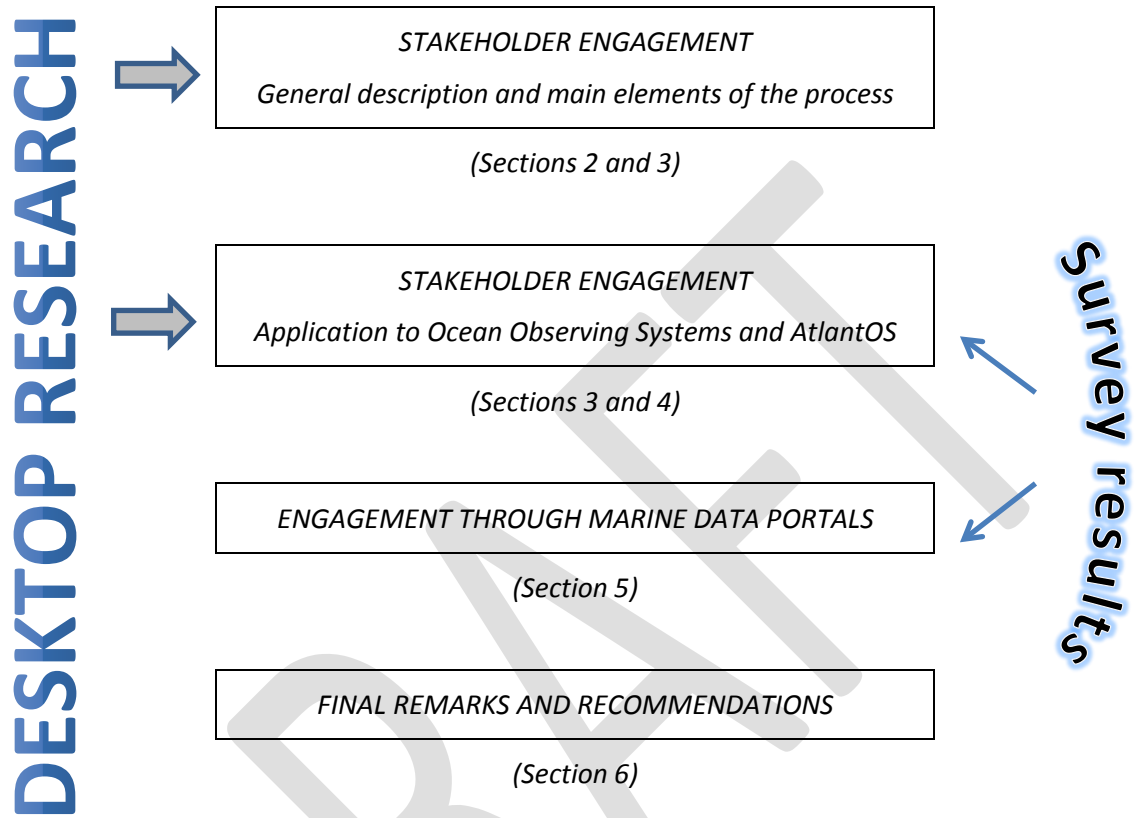


Figure 1. Approach, contents and sections of the deliverable.

1.4 Survey design and consultation process

Examples of surveys were consulted to gather ideas on best practice in survey design and some trials were undertaken with volunteers to design an optimal questionnaire. The final questionnaire contained 18 questions distributed in three parts. The first part was aimed at gathering information about the participant and his/her organization. The second part dealt with identifying and prioritising stakeholder groups, and lead to questions on the benefits of stakeholder engagement and the different types of tools for engagement. The final part focused on marine data portals as an important tool to engage with users.

The survey was designed as an online consultation using SurveyGizmo software. It was launched on the occasion of the AtlantOS General Assembly that took place in Kiel, Germany, on 28-30 June 2016. The list of participants of the General Assembly was used to send two rounds of reminders (on 6 July and on 22 July) by email to encourage participation in the survey. In some cases, additional contact was maintained with certain participants, who had questions or requests. Participants were also invited to redistribute the survey amongst their colleagues. The number of contacted potential contributors was estimated to be approximately 200 (160 out of them had been in Kiel). The survey

was open until mid-August (7 weeks) and 89 full responses were obtained. Approximately 75% of the participants were involved in the AtlantOS project, but there were also contributors from outside the consortium, including 20 non-European participants. Exactly 54% of the participants stated that engaging with stakeholders was a relevant part of their duties. In addition to questions where participants were requested to assign scores, the survey also contained some optional open text questions. In this respect, it is worth noting that a majority of the participants responded to those open questions and provided more elaborated feedback and suggestions. Annex 1 contains the full online questionnaire as well as some figures describing the participants' profile. The results of the survey are also included and referred to in the deliverable where relevant.

2 STAKEHOLDER ENGAGEMENT PROCESS: WHAT DOES IT MEAN AND ENTAIL?

2.1 Setting the context

To gain a better understanding of how to efficiently relate to stakeholders and thus formulate recommendations for AtlantOS, it is important to first become familiar with some general aspects of the engagement process and its main elements. This section offers a first general description, introducing basic concepts and vocabulary.

“Stakeholder engagement” can be described as an organization’s efforts to understand and involve stakeholders and their concerns in its activities and decision-making processes. Engaging properly with stakeholders implies having a clear idea of who they are, their needs and interests.

A stakeholder or stakeholders, as defined in its first usage in a 1963 internal memorandum at the Stanford Research Institute, are "those groups without whose support the organization would cease to exist". The theory was later developed and championed by R. Edward Freeman in the 1980s and the definition was broadened to include “any individual or group who can affect or is affected by the achievement of the organization's objectives”.

Despite being initially coined in the framework of strategic management of corporations, the term has become popular in many other fields and it is often used when talking about any kind of project and hence it can be applied to AtlantOS. Whilst a more detailed description of the concept of stakeholder and their category types will be presented in Section 3.2, we can use now the definition appearing in the AtlantOS Engagement Strategy where a stakeholder is “a person, group or organization that may be affected, impacted or have an interest in the AtlantOS project and the project’s outputs, either directly or indirectly”. This is a broad understanding which can include many different stakeholders with different characteristics and relevance.

2.2 Levels of engagement

Engagement implies some kind of involvement and participation. This engagement can take place at different levels and be more or less intense depending on the characteristics of the stakeholders, their interests and their relevance in the project. To begin with, the engagement process can be conceived as a two-directional one, where there is an active dialogue with the stakeholders, who can provide feedback to the project and influence its development. However, certain groups of stakeholders, even though potentially crucial for the project success, can play a passive role, being merely receptors of the project’s outputs. In this case the process would be a one-directional one, from the project/system towards its users.

Another aspect to take into account when considering the levels of engagement, is the interest and the influence that a concrete stakeholder can have in the project/system. Intuitively, higher levels of engagement will be sought with those stakeholders who have more interest or greater relevance to the project/system.

Informing, consulting, involving and **collaborating** are the four levels of engagement (from the lowest to the highest) that are described in the BiodivERsA handbook, which focuses on research projects. With this perspective, the stakeholders pertaining to the **inform** level are described as those who have little interest in or influence over research outcomes. If there are limited project resources,

there is less need to consider them in much detail or to engage with them. Nevertheless, it can still be convenient to keep them updated with balanced information, tailored to their needs.

One can also think of stakeholders who are supportive of the project and willing to provide feedback and as such they can be **consulted**. These stakeholders, however, typically have a limited capacity or even knowledge to interact, so that their potential impact in the project is limited. Consequently, engagement must be adapted and they should not be overwhelmed with too much information.

Unlike the previous category, stakeholders who must be **involved**, are adequately and regularly contacted. This is not necessarily because they have a strong interest in the project themselves, but because they are influential. In this regard, the project must make sure that their concerns and expectations are taken into account when making decisions.

Finally, there are stakeholders who are essential to the project both in terms of their interest and their influence, and in this case the project must foster partnership links with them, making an effort to keep them satisfied and searching for their fullest **collaboration**.

The level of engagement with stakeholders is likely to vary throughout the project lifecycle, as their roles can evolve.

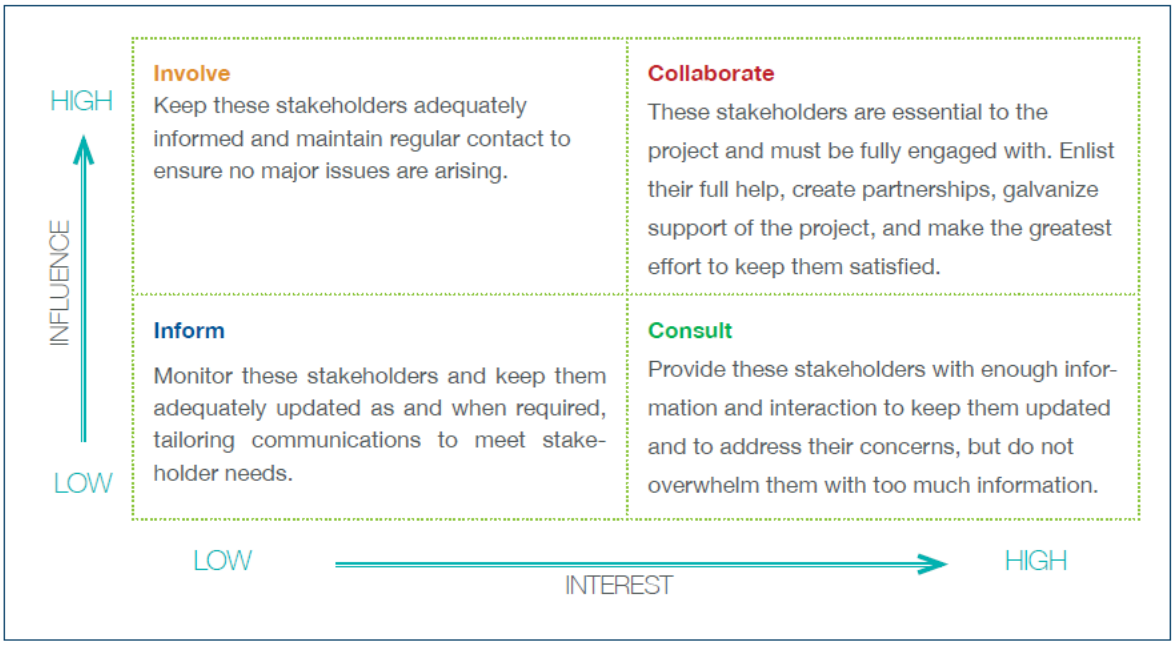


Figure 2. Relationships between different levels of engagement and the stakeholders' interest/influence (taken from BiodivERsA handbook).

3 STAKEHOLDER ENGAGEMENT ELEMENTS: WHY, WHO, WHEN AND HOW

In the next sections the methodology presented in the BiodivERsA handbook has been adopted. This describes a number of key elements that must be considered for an effective stakeholder engagement and is adapted to AtlantOS.

3.1 REASONS FOR ENGAGING (WHY)

Knowing the reasons why engaging with stakeholders can be beneficial is an essential first step when defining a good engagement strategy. When reasons are clear and well defined, it is easier to establish the focus and to select the tools to be used in the engagement process. It is also worthwhile to reflect on what the desired outcomes of the engagement process are. If engagement is perceived as beneficial this will act as a motivation to invest resources on it.

The next section provides an overview of all those possible reasons or benefits, following the approach outlined in Section 1.3, i.e. from the general ones (which may apply to all kind of projects) to those considered specific to AtlantOS. Some reasons for engaging through data portals will also be presented, as they are key tools to facilitate the dissemination of data and their exploitation by users.

General reasons for engaging:

- Gather ideas: stakeholders can provide insights on the project and contribute suggestions to improve activities and develop a better strategy
- Gather information: liaising with stakeholders results in information about their needs and requirements, the project can be tailored to address these and in turn derive users
- Raise the profile: having a good communication with stakeholders can improve the project's image, gain the users' trust and in general enhance its reputation
- Increase impact: if communication with stakeholders is fluid and efficient, the uptake of the project outputs will improve and their relevance will be higher
- Get support: when stakeholders are properly involved they can act as advocates of the project, ultimately improving the possibilities of obtaining endorsement and sustained funding resources

Reasons for engaging in the framework of AtlantOS and the future observing system:

- Enhance the provision of data: a fluid communication with data providers will improve the data flow to the observatory
- Get more contributors: AtlantOS could engage with new partners who collect marine data (not necessarily scientists) and convince them of the benefits of contributing to the observing system
- Get more users: successful engagement with stakeholders who can benefit from the existence of an Integrated Atlantic Ocean Observing system, will enlarge AtlantOS user-base
- Improve value chain: facilitate the path between the products and services that AtlantOS and the future observing system can deliver, and uptake of these by its users
- Serve as example: promote the resulting Integrated Atlantic Ocean Observing System as a regional node "best-practice" that could be adapted and applied to other sea basins

Reasons for engaging through data portals:

- Disseminate data, metadata as well as products and services, and ultimately knowledge derived from those data
- Improve the quality of data and metadata: users can point out defaults in datasets, broken links etc.
- Multiply the effects: intermediate users of data can use portals as a showcase of the products or applications they have developed
- Establish priorities: the digital medium enables tracking and optimisation based on user behaviours. This can help agencies, for instance, to determine which variables are more in demand and hence more worthy of support

The Stakeholder Engagement Survey (see Annex 1) included a section where participants were presented with a list of possible reasons for engaging and were asked to indicate whether those reasons were relevant or not, for their parents organizations and in the framework of AtlantOS. The results of the survey show that improving the dissemination and impact of activities is the main objective in both cases, whereas the "customer" perspective (trying to get more users or selling services to them) is considered less important. Results for those respondents who identify themselves as working as scientists, for public bodies or NGOs are quite homogeneous and similar to the ones obtained when all participants are considered globally. However, scores differ to those obtained from participants belonging to the private sector who indicate that the most important reason for AtlantOS to engage with stakeholders should be obtaining information about the users and how to better meet their needs.

3.2 MAPPING OF STAKEHOLDERS (WHO)

3.2.1 *Stakeholders: identification, categorization and prioritization*

Once the motivation is found (the WHY), the next step consists in taking into consideration all possible actors who could influence or who could be affected by the project. Identifying all those stakeholders, establishing their characteristics and needs is indispensable to the development of an effective engagement process. When resources are limited, it is also convenient to classify them according to their relevance.

In this section a revision of all possible groups that may qualify as stakeholders for AtlantOS is provided. In addition these groups are classified into **categories** which present certain common characteristics according to different perspectives. Categories can help to understand stakeholder interests and roles in relation to the project, and this will in turn ease the definition of the type of interaction that can be established.

The categorization is used to prioritize stakeholders according to their importance and influence over the project. The prioritization can also reflect the level of current engagement; for instance, there may be stakeholders that, despite being very important, are already sufficiently engaged and thus resources shall be used elsewhere. As mentioned, the focus will be on stakeholders who are users of AtlantOS and future observing system's outputs. The categorization can be further refined and developed as the project goes on: some groups can stand out as particularly relevant and some of the stakeholders may bring on new groups.

The BiodivERsA handbook identifies an *ad hoc* and an *ex ante* way of approaching the identification and suggests doing this in a systematic fashion by considering all aspects of the project's area of influence throughout the entire cycle. The *ad hoc* way uses secondary data sources to identify a seed group of stakeholders who can then provide feedback and help to identify new stakeholder in an iterative process. In the *ex ante* approach stakeholders are identified at the onset, according to some previously established stakeholder categories, normally reflecting relevance or functions within the project. In this section we will use the second approach, taking into account the documents consulted during the desk research stage as well as a number of strategic documents related to AtlantOS project such as the EC Horizon 2020 call BG-8-2014[7], the Grant Agreement and the AtlantOS Engagement Strategy.

First categorization: internal vs. external

AtlantOS Engagement Strategy establishes a first broad grouping of stakeholders in internal and external stakeholders (Figure 3).

Figure 3. Diagram showing the two main stakeholders categories and some key groups within them (taken from the AtlantOS Engagement Strategy).

Internal stakeholders are members of AtlantOS project whose activities ultimately result in the delivery of data, products and services through AtlantOS. These internal stakeholders are involved in the planning and developing of AtlantOS activities and thus have a clear stake in its performance and completion. In terms of the AtlantOS partnership these include ocean observatories and networks, universities and research centres as well as private companies. Members of those entities typically have a scientific background and work in the area of marine research, but this can be very diverse: from network operators to data managers, from PhD students to senior researchers. Internal stakeholders can be seen mostly as data providers, even though they can obviously also be users of AtlantOS outputs.

[7] https://ec.europa.eu/research/participants/data/ref/h2020/wp/2014_2015/main/h2020-wp1415-food_en.pdf

A stakeholder could also be external to the project, for instance, individuals who are not part of AtlantOS consortium but make use of the observations and models produced by the observatory for their own purposes. These **external stakeholders** may not have heard necessarily about AtlantOS, but can profit from the project's outputs or activities. Even if their role is somehow more passive (they are not undertaking any of the project activities), they can also be affected by the project and they will be in the position of providing insights to the project's work.

Second categorization: providers vs. users

Another interesting perspective appears when considering that the AtlantOS project aims at developing an Integrated Ocean Observing System for the Atlantic region. In this sense, a more specific definition for stakeholder adopting Rayner's contribution to the US IOOS summit[8] can be used. Accordingly, AtlantOS stakeholders could be regarded as those individuals or organizations with an involvement in the planning, construction, operation or use of the Integrated Atlantic Ocean Observing System components. Rayner continues to define three categories: providers, intermediate users and users. This categorization will be used and adapted to AtlantOS as follows:

Providers: This category encompasses those agents who generate either infrastructure or data within AtlantOS. Consequently, this can include manufacturers of sensors, instruments and platforms, those building, launching and operating satellite systems; providers of the cyber infrastructure that interconnects AtlantOS elements; organizations that develop and maintain the data management systems, software, tools and models that are used to turn AtlantOS data into useful information. It also includes those organizations that operate oceanographic equipment (generally public research agencies, but not only) or observational networks. Providers of data in the context of AtlantOS belong in most cases to the scientific community. Within the framework of the FP7 funded GMES in-situ Coordination (GISC) project, a report was produced[9] which provided interesting insights on how to ensure the engagement of stakeholders in the context of the GMES programme (GMES, the Global Monitoring for Environment and Security programme, now called Copernicus[10]). Copernicus programme has points in common with AtlantOS. Indeed, one of the objectives of engaging with stakeholders who belong to the scientific/providers category, is convincing them of the benefits of contributing to AtlantOS. Scientists can see this contribution as an extra workload instead of considering it a win-win situation. It is important to explain those benefits better and offer assistance or training to overcome technical limitations that may impede those contributions. The report suggests to develop a list of benefits for data contributors (called "in-situ" stakeholders, in the report), and proposes a number of actions to raise awareness and enhance cooperation with them.

Data providers can also be found outside the scientific community. In 2015 DG MARE launched a call to streamline the data ingestion process so that data holders from all kind of sectors (public and private) could easily release their data for safekeeping and subsequent distribution through the European Marine Observation and Data Network (EMODnet) or other means[11]. Increasingly the potential of citizen science activities as important sources of diverse and timely data sets is being recognised (see Cigliano *et al.*, 2015[12] and references therein for a review). These activities have the

[8] Rayner, RF (2012). US IOOS summit white paper – IOOS stakeholders and beneficiaries as part of the US IOOS. http://www.iooc.us/summit/white-paper-submissions/
[9] http://gisc.pbe.eea.europa.eu/deliverables/d1.1.pdf
[10] European Earth observation programme Copernicus
[11] https://webgate.ec.europa.eu/maritimeforum/en/node/3754
[12] Cigliano et al. (2015). Making marine and coastal citizen science matter. http://dx.doi.org/10.1016/j.ocecoaman.2015.06.012

potential to generate large amounts of data, with limited funding and can contribute to addressing important knowledge gaps[13]. Appropriate support and training can ensure the scientific rigour of the data collection and the quality of the data. Technological advances and in particular the developments of tools such as the jellyfish monitoring application developed by Jellywatch[14] also contribute to engaging and supporting the general public in data collection.

Intermediate users: This category includes those service-providers organizations that can add value to AtlantOS outputs tailoring them for specific end-uses (for instance, a company using meteorological, tide gauge and bathymetric data to develop a high resolution traffic model for harbour authorities and operators). As highlighted in Rayner (2012)[15], the delivery of end-user benefit is rarely a simple linear end to end service chain. More usually, intermediate users manipulate and integrate different sources of data and information (not exclusively marine) to develop a product useful for a particular purpose. Intermediate users will only be capable of doing that if they have the appropriate access to those sources. The setting up of an ocean observing system by AtlantOS could support blue growth by acting as a gate to those marine data, unlocking them and facilitating their usage by intermediate agents.

The first EMODnet Open Conference (Oostende, 20th October 2015) included a number of breakout sessions and panel discussions which dealt with the role of EMODnet to develop added-value products and services. One of the suggestions put forward by the delegates was that this should be developed by private entrepreneurs providing products and services to end-users and not by scientists[16].

End-Users: They use data and information generated by the system as an input for their activities or businesses, for instance, an oil company using seafloor geological maps, or a windsurfer using forecasts for navigation. End-users are the agents that naturally come to mind when thinking of ways to improve the usefulness of a system. This deliverable will pay special attention to those agents who are end-users of AtlantOS outputs and it will be the focus of the third categorization presented next.

It is important to recognize that an organization or agent can belong to multiple categories in this complex landscape. There is a natural tendency to associate the category “internal stakeholders” with the “providers” one and to see “external stakeholders” mainly as users of AtlantOS outputs. But in reality this does not preclude the possibility that there are stakeholders who do not belong to AtlantOS partnership, but can contribute and thus being considered also as providers. Likewise, many of the members of AtlantOS partnership are not only providers, but also users (intermediate or end-users) of the project outputs. For instance, a University department can do research which implies gathering data (playing the role of data provider), which they will use as input for a model for a specific purpose (intermediate-user), whose operation may require other data produced within AtlantOS consortium (end-user).

[13] ‘Science for Env and Policy’ In depth report: Environmental citizen science. http://ec.europa.eu/environment/integration/research/newsalert/pdf/IR9_en.pdf
[14] http://www.jellywatch.org
[15] http://www.iooc.us/summit/white-paper-submissions
[16] First EMODnet Open Conference: Summary Report (2016). http://www.emodnet.eu/sites/emodnet.eu/files/public/OpenConference/EMODnet_Conf_Report.pdf

Third categorization: types of users

If we now focus on stakeholders who are users of marine data, it is common to establish another sub-categorization into four broad communities: (1) scientific community, (2) public bodies, (3) private sector and (4) civil society. Conceptually, the general characteristics of those four communities are easy to grasp and this makes the grouping helpful when offering general insights on how to engage with them. However, providing a comprehensive and yet precise definition of each community can be much more difficult if not unfeasible, as they are not necessarily mutually exclusive. On the other hand, as we have already mentioned many of the groups identified here as users could also play a double role and be considered as providers. Instead of a definition, we will approach the description of those communities by detailing groups of stakeholders under each of those four broad groups according to different criteria that we also specify.

(1) Scientific community

Scientists are clearly the most involved community in AtlantOS. It is possible to identify different types of individuals and entities that could belong to this community, whether they are also partners of AtlantOS or not. These include:

- Individuals: In the first instance, this would logically include all kind of researchers (PhD, postdocs, seniors…) working at university or other research centres. It could also involve other professionals like engineers and technicians supporting scientific activities, managing the observational and computational networks, developing technology etc.
- Entities: In addition to Universities and Research Centres, scientific work can be developed in other institutions, public and private: marine technological centres, Think tanks, R&D departments of private companies…

(2) Private sector

In spite of being much less involved than the scientific community, they can be extremely relevant. The project summary (Box 1) reads that AtlantOS will "increase the competitiveness of European industries, and particularly of the small and medium enterprises of the marine sector".

According a recent OECD report on the Ocean Economy[17] there are 6 Emerging Industries and 5 Established Industries:

- Emerging: Ocean-based energy (off-shore, wind, wave, tidal, thermal conversion); Off-shore and deep-water extraction of marine mineral resources (oil and gas, metals, rare earths); Marine aquaculture; Marine biotechnology; New forms of ocean tourism and leisure activity; Maritime monitoring, control and surveillance
- Established: Shipping; Shipbuilding; Fisheries; Traditional ocean and coastal tourism; Ports

[17] OECD (2016). The Ocean Economy in 2030 http://www.oecd.org/sti/the-ocean-economy-in-2030-9789264251724-en.htm

In the last years, DG MARE has commissioned a number of studies evaluating the characteristics of economic activities that depend on the sea[18] resulting in a distinction between Blue Growth Focus Areas and traditional sectors[19]:

- Blue Growth Focus Areas: Coastal and Maritime Tourism; Renewable Energy; Aquaculture; Mineral Resources; Blue Biotechnology
- Traditional sectors: Fisheries; Transport; Shipbuilding and Ship repair; Offshore Oil and Gas

(3) Public bodies

Professionals who work in the public sector can make use of AtlantOS outputs for the fulfilment of their duties to serve society. These can include politicians and policy makers, but also other technicians who are in charge of implementing those policies. Other public entities with remits that require the use of marine data are also part of this community, for instance, those related to environmental monitoring and protection, coastal management, search and rescue etc. Other considerations would include:

- Geographical scope: local/national/regional/supranational/international
- Different policies at several levels: locally, nationally, or at the European Union level (e.g. the Marine Strategy Framework Directive (MSFD) or the Maritime Spatial Planning (MSP)).
- Different objectives: funding agencies/operational agencies/policy makers/decision makers

(4) Civil society

Individuals and entities belonging to civil society can also have a genuine interest in the marine and maritime realm and thus be willing to use marine data and other outputs stemming from ocean observatories. Their capacities to take full advantage of those outputs, however, differ considerably from those in the other communities, as they do not necessarily have enough expertise to use them properly. Amongst individuals, students of all ages are an important target group when developing outreach activities. This contributes to increased awareness of the importance and potential of ocean observations, and plant the seed for a full engagement as they mature. Citizens can also organise themselves in local associations concerned about the state of their coasts and sea. Providing citizens with accurate and timely data on the state of their local environment leads to a more informed or 'ocean literate' community. A more informed civil society leads to better ocean governance and greater transparency. Certain entities such as NGOs are also very reliant on marine data to support their activities and can be extremely influential in influencing environmental policy.

3.2.2 *Stakeholders: their needs*

Obviously, the way to engage with stakeholders will depend greatly in what their needs are with respect to AtlantOS. The H2020 Columbus project has produced a deliverable titled "Portals and Repositories and their role in Knowledge Transfer to support Blue Growth"[20] where they consider which are the most important marine data and information needs of the four major user communities we have outlined previously. We will be using part of their findings in what follows.

[18] https://webgate.ec.europa.eu/maritimeforum/en/node/3551
[19] http://ec.europa.eu/maritimeaffairs/policy/blue_growth/infographics
[20] http://www.columbusproject.eu/

Currently the **scientific community** is probably the largest group of users and providers of marine data. It is a community that sits in the "high influence/high interest" area of Figure 2 and as such, engagement must be intense and continuous. Nevertheless, since they are the community more naturally involved in projects such as AtlantOS, this engagement is more straightforward. For instance, understanding and matching the scientific community requirements in terms of ocean observations is relatively easier as those observations are produced mainly by that community. Scientists are best positioned to know what observations are available, where and how to obtain it. Even if all efforts to promote a good communication must be undertaken, it is also clear that the exchange of information is likely to be more easily established and maintained between pairs, and it will benefit from already established connections.

With respect to the **private sector**, as indicated in the Horizon 2020 call BG-8-2014 it is expected that AtlantOS will (1) improve modelling outputs and reduce cost of data collection in support of ocean-related industrial activities; (2) increase competitiveness of European industry and particularly SMEs within the marine industrial sector; and (3) Contribute to make better informed decisions and documented processes within key sectors (manufacturing, ICT, maritime industry, environment technology, marine science and fisheries). It is obvious that industry should be one of the target users for AtlantOS. However, getting to know the requirements of the industry sector proves particularly challenging. In this respect, numerous events try to put in contact the ocean observation community and the industry, in an attempt to facilitate the communication between both sectors. For instance, an interesting event on the benefits of improved observation and prediction of our oceans and sea was held in London in 2015, organised by IMARest[21] including a number of talks describing user requirements in certain key private sectors like oil and gas, renewables or ports and transports.

Programmes like Copernicus, have investigated users preferences through public consultations such as the survey launched in July 2015[22]. The survey presented several questions, the responses to which would be used to take decisions on the future development of the programme. For instance, users were asked to indicate what they expected to use the service for, from simply viewing data to producing their own value-added products.

Not surprisingly, each industrial sector present very specific needs which cannot always be fulfilled by observational networks and data infrastructures in their present state. This is where the intermediate users come into play, by developing tailored products and services for other users. These intermediary companies can be the bridge between the AtlantOS community and the private sector, but they need to be better informed about what is available for them to contribute to Blue Growth. Workshops like the one conveyed by DG RES in 2014[23] or the most recent one in 2016 [24] addressed the needs of the private sector in terms of Earth Observations. Engagement with the private sector seems more advanced in the field of space observations and the remote sensing community could be used as a reference for the oceanographic one[25].

[21] http://www.imarest.org/events-courses/events-conferences/oceans-of-knowledge
[22] http://marine.copernicus.eu/take-part-in-the-european-commission-copernicus-data-and-information-user-survey
[23] Workshop "Engaging the Private Sector in GEOSS – A European Perspective". Brussels, 26 September 2014 http://geo.pbe.eea.europa.eu/library/europe-geoss/conclusion-workshop-engaging-private-sector-geoss
[24] https://ec.europa.eu/eusurvey/runner/InnovationEarthObservationMarket
[25] Minutes of the 6th EMODnet Steering Committee. Available at the DG MARE Maritime Forum. https://webgate.ec.europa.eu/maritimeforum/en/frontpage/159

The needs of **public bodies** can be very diverse as they can have very different purposes. An OECD recent report[26] states that "Science advice is playing an increasing role in the formulation of policy and decision-making. Governments require scientific evidence in a wide range of situations, from long-term policy development through to urgent crisis management". Public bodies require advice based on the best scientific evidence, with an estimation of uncertainty. Advice should be generated and used in a transparent and accountable manner. In many cases, decision making will require the integration of input from many different fields of expertise. Public bodies may also use ocean observations to comply with legal requirements, for instance, for implementation of the MSFD and MSP. Previous projects have addressed issues related to the dialogue between the ocean observing community and policy community. For instance, the STAGES project insists on the importance of independent Knowledge Brokers with interdisciplinary expertise spanning science, policy and communication to filter, package and translate MSFD relevant knowledge to different target audiences[27]. On a more technical note, the environmental monitoring required for implementing MSFD presents high demands in terms of data collection methodologies, Quality Control and Assurance (QA/QC) and metadata.

The development and implementation of MSP requires the access to sound information on maritime human activities together with information on the marine environment, such as the one provided by ocean observatories. A project commissioned by DG MARE ("Assistance mechanism for the implementation of maritime spatial planning" [28]) analyses in length planners' needs in terms of data and information. One of the initials realisations stated in a preliminary report is that "much of the information used to generate evidence is likely to be produced by bodies other than the responsible planning authority, so it requires synthesis and further analysis and/or interpretation before it can be used to support the development of marine plans". In short, public bodies need some kind of translation in order to take advantage of marine data and rarely can use raw data as such.

Finally, **civil society** is also an important user of marine data resources but often forgotten. Citizens require reliable information in the same way as other users, but their demands may be less specific than those of scientists, for instance. For non-specialists, it is important that the information is presented in an attractive, clear and easy-to-understand way. In addition, these individuals may not be aware of where to source data nor will they have access to the resources which science and industry have. For these reasons public initiatives must consider how to engage them in a targeted way. NGO's working on marine conservation and other marine related issues often also rely on ocean observations to support their activities. As for the general public, these NGO's do not always have the necessary in house expertise to find, retrieve and translate the observations into knowledge products. They need to be better informed about what is publicly available and receive tools and training to be able to use these observations.

3.2.3 *Stakeholders: priority groups within AtlantOS*

A first indication on potential priority groups for AtlantOS can be found in the description of the project. Indeed, Work Package 8 ("Societal benefits from observing/information systems") will produce a suite of products to promote economic development in key marine and maritime sectors

[26] Scientific Advice for Policy Making: The Role and Responsibility of Expert Bodies and Individual Scientists http://dx.doi.org/10.1787/5js33l1jcpwb-en
[27] http://www.stagesproject.eu/images/STAGES/deliverables/STAGES_D4.2.pdf
[28] http://ec.europa.eu/dgs/maritimeaffairs_fisheries/contracts_and_funding/calls_for_tender/2014_23/index_en.htm

through better decision support tools (Visbeck et al., 2015)[29]. The sectors covered by the project are coastal flooding, maritime safety, harmful algal blooms and resource assessment for offshore aquaculture. There are also activities linked with developing reanalysis products for managing MSFD compliance and fisheries. On the other hand, the AtlantOS Engagement Strategy mentions specifically a number of funding agencies with whom a structured dialogue should be established (e.g. ERA-NET GEO, JPI Oceans, European Marine Board, DG MARE and DG GROW).

To complement this initial indication, participants on the survey (see Annex 1. Stakeholder Engagement Survey) were presented with a list of stakeholders and were asked to state whether they considered them important or not.

The most evident result obtained from the survey is that participants consider the scientific community as a target user of AtlantOS outputs, followed by public bodies. Groups of users falling under the civil society and the private sector categories are considered less important. This result is clear and consistent and does not depend on the participants' profile. So, most of the participants (not only those who identify themselves as scientists) fully agree that the scientific community is an important stakeholder and assign the highest score to that group. Results do not change either when the participant refers to its own activities or those of AtlantOS. In other words, participants seem to consider that groups of users which are more important to them are also potentially more important for AtlantOS.

Generally scores are slightly higher when participants are answering in the AtlantOS context. This is because they are more inclined to assign low values (scoring 1 or 2) to certain activities they know for sure are not presently related to their work, whereas when giving opinions about AtlantOS, they tend to score above 3.

It is worth noting that amongst the different industries presented as potential users for the private sector category, Fisheries is considered to be the most relevant sector. Other activities, such as Ship building or Mineral resources, on the contrary, are often considered irrelevant.

The survey contained a specific question related to intermediate users. A great majority (90%) of the respondents believed that intermediate users should be a priority for AtlantOS.

Finally, establishing priorities can be helpful when resources are limited. Any engagement strategy will be more effective if it can address specific stakeholder needs and this may require selecting one or more groups and concentrating efforts on them. This selection should obviously depend on the relevance of the stakeholder, but not only, as certain links may already exist and be well maintained whereas others may require specific "new" attention. When looking at the evolution of well-established ocean observatories it is possible to identify a general trend where those systems are still very much science-driven, but impact an increasing range of communities beyond the scientific one, and they are evolving in consonance, taking those new communities' demands into account, developing bespoke products. Some concrete examples of those developments will be further explained in Section 4.

[29] Visbeck et al. (2015). More Integrated and More Sustainable Atlantic Ocean Observing (AtlantOS). EXCHANGES. No.67 (Vol 19 No.2) http://www.pmel.noaa.gov/pubs/PDF/smit4391/smit4391.pdf

3.3 TIMING (WHEN)

The previous section has discussed types of stakeholders and Section 3.4 describes the tools and methods to engage with them. It should be highlighted now that levels of engagement will be different along the lifecycle of the project and it is likely that in many cases, engagement only takes place at discrete times. In other cases, however, long-term interactions may be preferable and resources will have to be assigned to this. This timing can affect the success of the engagement process, so it is important to take it into consideration. Once the mapping of stakeholders is done and their roles in the project are clarified, it will be easier to identify at which stage interaction will be more beneficial. An attempt to this identification is presented in the following table, which is a simplified version of a similar table in BiodivERsA Handbook which we have adapted to AtlantOS. This type of exercise could be applied in the framework of AtlantOS Task 10.3 ("Towards a durable Stakeholder Engagement Support Facility"), aimed at implementing a test process to explore the practice of structuring the dialogue and information exchange with private stakeholders. The table does not intend to be exhaustive, but simply seeks to serve as an illustration of the approach.

Table 1. Distribution of possible private stakeholder's roles during the life cycle of AtlantOS.

Project stage	Role of a private AtlantOS stakeholder
BEFORE	• Define AtlantOS concept and strategy • Identify other potential stakeholders
DURING	• Uptake of data, products and services • Provision of feedback: suggestions, information about needs • Provision of data and/or products
AFTER	• Act as an advocate for AtlantOS and future observing system • Suggest priorities for future development of the observing system

3.4 ENGAGEMENT TOOLS (HOW)

Tools for engaging can be very diverse, depending on the objectives, the types of stakeholders, their relevance for the project, the moment where the engagement will take place and so on. Some of the tools will be useful for opening up dialogue and gathering feedback from stakeholders. Some others will be more useful to provide information in a more unidirectional way. Stronger collaboration can be achieved with tools oriented to motivate participants in a more direct, interactive way.

The purpose of this section is to provide a comprehensive overview on the engagement tools more frequently used in the framework of research projects which will be complemented by insights obtained from analysing the results from our AtlantOS stakeholder engagement survey.

3.4.1 *Types of engagement tools*

Given its diversity and varied purposes and features, it is convenient to classify engagement tools in types that present common characteristics. In this report, we define four types, from the most traditional to the most recent ones:

Printed materials: These include documents printed in hard-copy for reading, including dissemination material like brochures and leaflets, but also documents for experts (policy briefs, scientific papers). In spite of many other online tools in common use nowadays, printed documents remain a fundamental means of communication, not only to transmit, but also to solicit feedback. Some documents and printed materials are explicitly intended to initiate discussion such as vision documents, concept notes, white papers, discussion papers etc., expressing the views of a community and/or outlining possible options for future action. In these cases, an interactive process can be held to stablish and foster discussion within members of the concerned community to agree on an outcome which reflects the views of the relevant stakeholders

Face to face: This type of tool comprises all kinds of activities that imply personal interaction, from one-to-one interviews to meetings with groups of experts and convening big conferences. Face to face methods of engagement are demanding in terms of time and resources, but they are generally considered most effective to get a fruitful response from stakeholders. This is particularly true when stakeholders lie in the low interest/high influence area of Figure 2 (for instance, a decision maker or a funding agency).

Online tools: Computer-mediated tools that enable engagement provided there is internet connection, for instance skype calls, webinars, youtube videos… Websites in general and data portals are also online tools which are particularly important in the framework of ocean observatories as we shall see in Section 5. Mobile applications (apps) are designed to run on mobile devices such as smartphones and tablet computers and in the last few years they have become almost indispensable to provide all kind of services to users.

Social media: These refer to platforms that enable the sharing of information amongst users, who can reach and interact with large audiences remotely. Social media are also online tools, but deserve special attention due to their current societal relevance. Annex 1 in the BiodivERsA handbook addresses specifically the topic of social media for interacting with stakeholders. Facebook, Twitter and YouTube are amongst the most used platforms by researchers. The handbook stresses the importance of turning those platforms into real means of participation (“enabling a conversation”) instead of simply using them as a way to disseminate information and includes practical tips on how to use each of those platforms effectively.

Webpages such as http://stakeholdermap.com/ provide advice for project managers on how to manage their stakeholders and contain useful general information including a list of stakeholder engagement approaches that have been modified and expanded taking into account the specificities of the AtlantOS project. The resulting expanded list of tools, classified according to the previous four types is presented in the following table (Table 2).

Table 2. List of engagement tools in alphabetical order, classified into four types.

TYPES OF TOOLS

Face to face	**Printed materials**
Online tools	**Social media**

LIST OF ENGAGEMENT TOOLS (ALPHABETICAL ORDER)

1	Advisory panels	32	Open days
2	Apps (for mobile phones, tablets…)	33	Phone calls
3	Blog	34	Podcast
4	Brochures	35	Policy briefs
5	Conferences (large meetings)	36	Polls
6	Displays and exhibits	37	Posters
7	Dashboard	38	Practical demonstrations
8	Door knocks	39	Press releases or conferences
9	Email	40	Project meetings
10	Fact sheets	41	Public meetings
11	Facebook	42	Questionnaires/Surveys
12	Focus groups	43	Scientific paper
13	Formal memos	44	Scientific conferences
14	Forums	45	Section/article in a publication
15	Games and contests	46	Skype calls
16	Google	47	Social media
17	Hoardings	48	Socialising (corporate hospitality)
18	Infographics	49	Steering groups
19	Information hotline	50	Surgeries/Advice columns
20	Instagram	51	Teleconferencing
21	Interviews (in person)	52	Tutorials
22	Internal Meetings	53	Twitter
23	Leaflets	54	Video conferencing
24	Lectures and talks	55	Videos
25	Letters (addressed)	56	Visits
26	Linkedin	57	Walking tour/site tour
27	Magazines	58	Webinars
28	Media / news items	59	Website
29	Memos	60	Wiki
30	Newsletters	61	Workshops
31	One-off Circulars	62	Youtube or Vimeo

Choosing the most appropriate tool will depend of course on the targeted stakeholder but also on the level of engagement we want to achieve. Hence, while planning the engagement strategy it can be helpful to keep both factors in mind when considering the type of tools at our disposal. An attempt in that direction is provided in Table 3, which shows a few tools that can be of relevance for a project such as AtlantOS and presents it according to the two aforementioned factors. This provides a suggestion of how AtlantOS could approach the selection when developing its engagement strategy.

Table 3. Examples of tools for the four main AtlantOS end-users groups, according to increasing levels of engagement.

TYPES OF TOOLS

Face to face	**Printed materials**
Online tools	**Social media**

Example of AtlantOS stakeholder (and categories)

TOOLS FOR ENGAGEMENT	**Tourist** (External, Civil Society)	**Search&Rescue Agency** (External, Public Body)	**Oil&Gas Company** (External, Private Sector)	**Research Agency** (Internal, Scientist)
Advisory group		CON	INV	COL
Lectures &talks	INF			COL
Steering group		CON	INV	COL
Workshops	INF	INF, CON	INF, CON, INV	COL
Blog	INF			COL
Email	INF	INF	INF	INF
Webinars	INF	INF, CON	INF, INV	INF, COL
Facebook	INF			INF, INV
Linkedin		INF	INF	INF, INV
Twitter	INF	INF		INF
Infographics	INF	INF	INF	INF, COL
Policy briefs		INF, INV		
Scientific paper				INF, COL
LEVEL OF ENGAGEMENT	**Inform (INF)**	**Consult (CON)**	**Involve (INV)**	**Collaborate (COL)**

The survey provided an opportunity to derive complementary insights into this topic by including a section where participants were requested to rank tools for engagement according to the relevance they had for their work and for AtlantOS. Results are generally very homogeneous: participants consistently give preference to face-to-face tools such as workshops or conferences to reach

stakeholders. On the contrary, questionnaires and surveys rank low and are considered irrelevant by 15% of the participants. There is only one notable exception in this homogeneous response. Interestingly, but maybe not that surprisingly, participants working for the private sector indicate that policy-briefings are essential tools for AtlantOS, whereas they consider them only as fairly relevant for their own work. Another finding concerns the number of “Don’t know” responses. Participants seemed to be considerable more hesitant about the tools to be used in the framework of AtlantOS than for their own activities.

Participants were also solicited to justify their choices and to suggest more tools. A total of 39 participants provided valuable extra feedback and it was possible to distil some common messages. They insisted recurrently in the greater effectiveness of personal interaction, especially when trying to reach decision makers. They also pointed out the high potential of social media, even though they also specified that they had to be used very carefully depending on the audience.

4 STAKEHOLDER ENGAGEMENT IN OCEAN OBSERVING SYSTEMS

4.1 Introduction

The establishment of broad-scope ocean observing systems in many developed countries such as the US, Australia, Canada or Germany responds to the increasing need of oceanographic information for national waters management, while taking advantage of their well-developed scientific and technological communities. At a European level, the importance of ocean observations for sound environmental and spatial management of our seas is also well recognised by the European Commission (EC), and are considered essential for the implementation of European directives and policies such as MSFD or MSP as described in several EC documents[30] [31] [32]. In the last years, the plead for the development of a European Ocean Observing System (EOOS) that can contribute to a Global Earth Observing System of Systems (GEOSS) is gaining momentum, as shown recently at the occasion of an event in the European Parliament, "Building a European Ocean Observing System", where EOOS progress was presented[33]. To achieve their goals, these ocean observing systems must develop a successful engagement with stakeholders at all levels.

But what is the "raison d'être" of ocean observing systems? In its simplest terms, these systems provide data on the state of marine waters. This is a deliberately loose definition. For instance, data can be acquired with different types of platforms: vessels, in-situ platforms like buoys, but also with satellites. It can mean real-time data, but also historical climatologies or, looking ahead, predictions. Data can be obtained directly from instruments (observations), but they can also be derived from models, not only forecasts, but also hindcasts. It is also important to bear in mind that data produced by ocean observing systems can be used to generate products (such as maps or animations) and ultimately information and marine knowledge. Related to this, the generation of such knowledge requires not only of the monitoring and modelling infrastructure to acquire and produce the data, but also of capabilities to manage, process them and disseminate them in a meaningful way (hence, the need to go beyond the provision of raw data). So, when we refer to ocean observing systems we will be talking of endeavours presenting all those capabilities.

4.2 Stakeholder engagement: steps to follow

In this section, we will look for examples of well-developed ocean observatories running all over the world to see how they engage with their key stakeholders, and more in particular with their users. The notion of stakeholder, progressively narrowed to the concept of user, is relatively new to the world of ocean observatories (compared to the business world) but it has gained importance in the last years. One of the reasons for that is the realization that the sustainability of those observatories rely heavily on their capacity to maintain a pool of users taking up their outputs. And, as illustratated in previous sections of this report, this is not always straightforward. The understanding of how to engage with users has improved and it is now being documented extensively. Amongst the sources of information available, an excellent example is provided by the US Integrated Ocean Observing

[30] European Commission (2010). EC Marine Knowledge 2020:Marine data and observation for smart and sustainable growth, 8.9.2010 COM (2010) 461. http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex:52010DC0461
[31] European Commission (2012). EC Green Paper Marine Knowledge 2020: From Seabed Mapping to Ocean Forecasting COM (2012) 473 final. http://ec.europa.eu/maritimeaffairs/documentation/publications/documents/marine-knowledge-2020-green-paper_en.pdf
[32] European Commission (2013). Towards Eu-ropean Integrated Ocean Observation. Expert Group on Marine Research Infrastructures Final Report. 96 pp. ISBN 978-92-79-27319-3, doi: 10.2777/29343
[33] http://eurogoos.eu/events/eoos-event-european-parliament/

System (IOOS) summit report[34], which summarizes the results of the US IOOS Summit which took place on November 2012.

The US IOOS Summit report assessed progress achieved by IOOS over the past decade and developed plans for the future. In terms of scope and complexity, the US IOOS stands out as a particularly appropriate reference for the future ocean observing system that may result from AtlantOS project. The report contains a section specifically devoted to user engagement, with clear information on how to approach the process, based on the broad experience acquired since the system inception, in the 1990s. Figure 4 taken directly from that summit report, depicts the eight steps required for a successful user engagement. Those steps are presented in a circle to suggest an iterative process, where the different stages follow a logical chronological order, even though they can also happen simultaneously.

Figure 4: The Steps Required for Successful User Engagement (taken from U.S. IOOS Summit report).

We will now describe the steps, and particularize it for the case of AtlantOS.

Step 1. Identify the users

This is a challenge in itself, as the range of potential users of marine knowledge is wide and not always well known by those who produce the knowledge. In Section 3.2 of this deliverable we addressed this issue and identified a number of communities paying special attention to those who could be users of AtlantOS outputs.

Step 2. Prioritize the users

Once the users are identified, it is convenient to select target groups amongst those users. This boils down to a pragmatic issue: when resources for engagement are limited, and taking into account that

[34] U.S. IOOS Summit Report: A New Decade for the Integrated Ocean Observing System. 2013 Interagency Ocean Observation Committee. http://www.iooc.us/wp-content/uploads/2013/01/U.S.-IOOS-Summit-Report.pdf

user requirements can vary widely, it is necessary to prioritize and give preferential attention to those who are considered more relevant for the system. Section 3.2.3 presented some suggestions of target groups for AtlantOS based on some of the project's strategic documents and the results of the AtlantOS Stakeholder Engagement Survey.

Step 3. Define user requirements

Intimately linked with the previous step, it becomes obvious that serving adequately a target group implies having a sound understanding of its needs. We have outlined some of those needs for the four communities defined in Section 3.2. AtlantOS must also be receptive and strive to get feedback from its users in order to better understand their expectations. The question to be put forward is not always "What do you want?" but instead "What problem do you want to solve?". In other words, engagement shall aim at gaining a deeper understanding of the concrete challenges users are facing so that project outputs can help them solve them.

Step 4. Develop Solutions/Products

Once the user needs are understood, the next stage in the engagement process is providing them with solutions to their problems. This works much better if done in a flexible, collaborative manner. Users are better at describing what they need when they are presented with a first option, so that they can describe what they like or don't like. New solutions and products can then be proposed based on the received feedback and recommendations.

However, it should be clear from the start that "one size does not fit all" and a dataset or product perfectly suited for one type of user may be totally useless for another. One way around it is to focus on providing the "raw" material of the highest quality (i.e. the data) so that intermediate users outside AtlantOS can then develop bespoke products.

Step 5. Conduct Outreach

It is a mistake to assume that good quality products will inevitably attract users. Users must be made aware of them and some resources must be dedicated to improving their uptake. However, this is easily overlooked by those who generate marine data or products, as they are mostly concerned with the outputs and less willing to enrol in "marketing" activities. As in the previous step, an alternative can be to focus on intermediaries who develop such activities and activating them to become ambassadors of AtlantOS. The appointment of ambassadors has already been considered in AtlantOS Engagement Strategy and a few individuals have been proposed to support AtlantOS awareness-raising activities.

Step 6. Assess and Maintain Products

Ensuring the system users' satisfaction through the provision of fit-for-purpose data and products is a long-term endeavour. Users' needs can change with time and the system must be capable of first recognizing those changes, and subsequently be able to evolve to address them. Once again, this requires an investment of resources to get periodic feedback from users as well as to update the system accordingly. This feedback can be obtained through passive methods such as surveys, or more direct ones, for instance by organizing workshops.

Step 7. Provide Training

Users may require training to take full advantage of the system's outputs. This is also part of the engagement process and requires specialized staff capable of providing that training. Many ocean observatories provide training as part of their outreach activities both through e-learning (tutorial

videos, webinars) or in-person courses. A large-scale example of this type of activities is the Sea Grant Extension program, further described in Section 4.3 of this deliverable.

Step 8. Increase Advocacy

Related to the sustainability of the system and fund raising, the last step in the engagement process concerns convincing users to promote and support the system, that is to say, to act as advocates. This may be a natural by-product of the engagement process when the previous steps are accomplished and the system manages to engage stakeholders, and more in particular to satisfy user needs adequately.

4.3 Examples of stakeholder engagement

A significant proportion of the desktop research work carried out consisted of visiting the webpages of a considerable number of ocean observing systems all over the world. These ranged in geographical scopes (regional, national, European, global), breadth of data provided (thematic scope), type of data production (in-situ observations, models, satellite) and also different types of users. Below some tables are provided, showing examples of user engagement that were considered to be particularly successful or inspiring. For each example the level of engagement, the type of user and the main type tool used for engagement is specified together with a brief description of the ocean observing system for context. A description of the engagement activities is presented and the main benefits obtained are underlined. In most cases this information can be found directly on the webpages whose links are provided in the following tables, complemented by additional sources such as project reports, dissemination materials and personal communications.

Table 4. SOCIB system.

Collaboration with Public Bodies and Private Sector using Face to face tools	
SOCIB: The Balearic Islands Coastal Ocean Ocean Observing and Forecasting System	
	
Link	www.socib.es
Geographical scope	Regional (Western Mediterranean)
Fields covered	Operational Oceanography; Physical Oceanography; Biogeochemistry
Short description	SOCIB is a multi-platform ocean observing system providing streams of data and forecasting services in the Western Mediterranean. It is integrated by three major infrastructures: an Observation Infrastructure (drifters, moorings, coastal stations, satellites, research vessel, radar, gliders, sea turtles...) (2) an Ocean Forecasting Infrastructure for currents, waves and tsunamis and (3) a Data Centre/Cyber-infrastructure for data archiving, processing, quality control, visualization and download.
Example of engagement with Public Bodies (Regional Government)	SOCIB collaborates with the Directorate General of Emergencies and Inner Affairs - Balearic Regional Government) and provides them with services through their Beach Monitoring Facility[35]. First **meetings** and **conversations** with the Regional Government were held while considering the modification of the law regulating beach management in the region, and associated variables that concessionaries would be measuring for that purpose. As a result, several initiatives were launched to take advantage of those measurements. For instance, SOCIB undertook a joint analysis of accidents and environmental conditions in **collaboration with safeguards** to improve beach safety. Lifeguard Beach Supervisors took data giving account of rescues, preventive actions and

[35] http://www.socib.eu/?seccion=observingFacilities&facility=beachMonitoring

	drownings and those were contrasted with wave data in order to find spatial patterns. During summer, SOCIB staff **engages directly in the field with safeguards teams** to inform them about monitoring activities that they carry out on the beach. On the other hand, safeguards use environmental variables provided by SOCIB system to fill in certain forms for the Directorate General of Emergencies and Inner Affairs.
Example of engagement with the Private Sector (Tourism)	SOCIB has a 15 year-long record of collaboration with local stakeholders from the touristic sector. This collaboration is the result of SOCIB's scientific expertise and reputation on the field of beach erosion and beach management. Thanks to SOCIB's efforts on reaching this sector, including organizing **one-to-one meetings with hotel managers**, the usefulness of beach monitoring was finally recognized, as beaches are one of the biggest assets in the region, and this has translated into different initiatives such as "SOCIB seaboard". Seaboards are visualizations of ocean data specifically designed for the tourist sector. Formal agreements were signed with interested hotels, so that video stations could be installed in their premises (overviewing beaches). This results in a **better monitoring capacity** for SOCIB and an **improved image** for hotels.

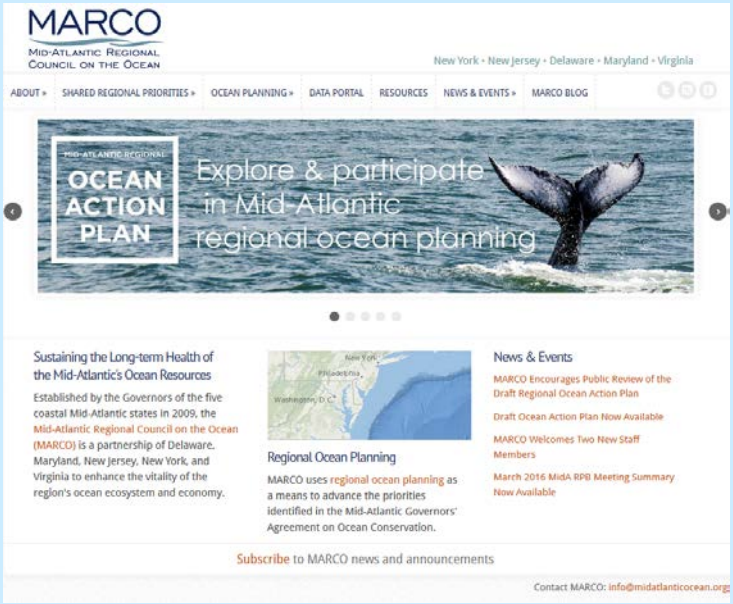
Table 5. FixO3 system.

Consultation with Scientists and Private Sector using Face to face tools	
FixO3: Fixed Point Open Ocean Observatories	
	
Link	http://www.fixo3.eu/
Geographical scope	Global (Atlantic and Mediterranean)
Fields covered	Physical Oceanography; Biogeochemistry
Short description	FixO3 is a network of deep ocean observatories working to harmonise their processes and technologies. FixO3 has built on the network originally developed in 2002 in the ANIMATE project which then grew to be the EuroSITES network, establishing practices which have continued to be developed and used. FixO3 encompasses both Atlantic and Mediterranean observatories, but several of the Atlantic sites will also be actively contributing to the AtlantOS project. This will build on the previous integrations to become part of the future Integrated Atlantic Ocean Observing System.
Example of engagement with scientists and the private sector (Oil and Gas companies)[36]	One of the objectives of FixO3 project is to promote interaction between the ocean observatory research community and the commercial sector. Face-to-face engagement activities included a first round of **interviews with FixO3 partners** to collect all relevant technical information on hardware, software and middleware characteristics of each FixO3 site.

[36] http://www.fixo3.eu/download/Deliverables/D5.2%20140826_FixO3_-%20FINAL.pdf

	One-to-one meetings were organized **with private equity companies** that provide venture capital investment for early stage companies with pioneering technologies. A number of ocean observatory technologies at TRL7 stage were presented including water quality sensors, anti-biofouling and deep water power and control systems. The meetings provided an opportunity to obtain insights into the future needs of, in particular, the oil exploration industry. Matching innovative scientific products with commercial needs will lead to **spin-out company formation** and the **licensing of new technologies** by companies. Further actions implied **attending events where the private sector was also participating**: at Oceanology International 2014 presentations were made to the Oiltech Investment Network and invitations to apply for access to the FixO3 observatory infrastructure were distributed to targeted exhibitors. Both occasions allowed **researchers to discuss industry needs with companies** in the marine realm **to get ideas** about possible further developments.

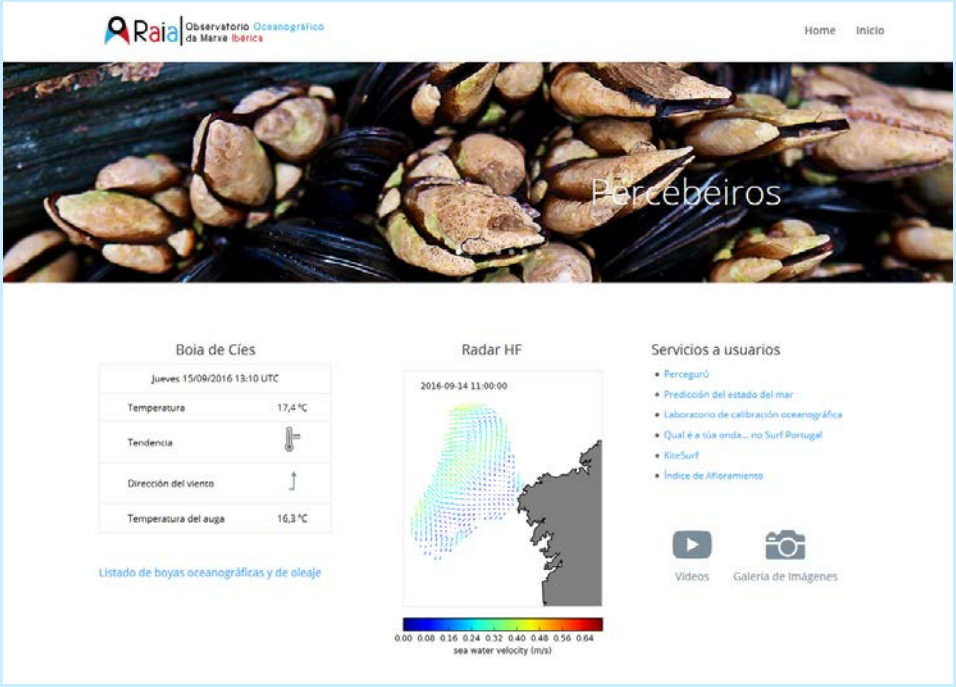
Table 6. MARCO system.

Consultation with Civil Society and Collaboration with Private Sector using Face to face and Online tools	
MARCO: The Mid Atlantic Ocean Council on the Ocean	
	
Link	http://midatlanticocean.org/
Geographical scope	Regional (US Atlantic coast: Delaware, Maryland, New Jersey, New York, and
Fields covered	Diverse fields including Human Activities
Short description	The Mid-Atlantic Regional Council on the Ocean (MARCO) is a partnership established to address regional priorities shared by 5 US states on the Atlantic coast (Delaware, Maryland, New Jersey, New York, and Virginia). These priorities are Climate Change Adaptation, Renewable Energy, Marine Habitats and Water Quality. MARCO leverages existing state and federal resources, knowledge, and partnerships to build a stronger base of information and experience to make well-informed decisions in the best interest of the states and their constituents. It has developed an ocean data Portal with a team that includes the Monmouth University, Rutgers University, The Nature Conservancy, EcoTrust and others.
Example of engagement with Civil Society (Indigenous people)	MARCO is not an ocean observing system strictly speaking, but provides an interesting example of **engagement with Civil Society, in particular with indigenous communities**. MARCO first convened **listening sessions** with tribal leaders, to share information about the process and explore their interest in participation. Some of those communities finally got **formally involved** in some of the MARCO Planning Bodies. Several meetings and discussions were held to make the Portal more useful for them, and there are plans for adding new map products. One priority they expressed was for the Portal to **better reflect** their views and voices through its editorial sections.

	Following **an interview** on their news blog with the Shinnecock Nation's representative on the Mid-Atlantic Regional Planning Body, where she offered some specific ideas for a new map layer showing the location of the Tribal headquarters, the portal was updated.
Example of engagement with Private Sector (Fisheries)	The "Communities at Sea" initiative[37] implied working closely with commercial fishing communities to create maps which show the places they rely on most, so that the **fishing is more cost-effective**. The data collection began with Vessel Trip Reports that are filed by the fishermen. Then, fishing professionals were **directly engaged in a series of workshops** held throughout the five states, asking them to review the data and provide their input on any issues they had with it.
Example of engagement with Civil Society (Recreational ocean users)	Use of visual aids such as maps are considered very useful during face to face stakeholder engagement activities such as workshops as they allow to present data and information in an easy to understand way for both scientists and non-specialists. For instance, the Surfrider Foundation organised one of those meetings in an **informal setting** (one local restaurant) with a lot of success. They set up a projector screen, zoomed in on the maps, and everyone took turns pointing to the maps and telling stories about what they saw instead of the normal more formal format. Following the workshops, a suite of "Coastal Recreation Maps" were created.

[37] http://portal.midatlanticocean.org/news/commercial-fishing-maps/

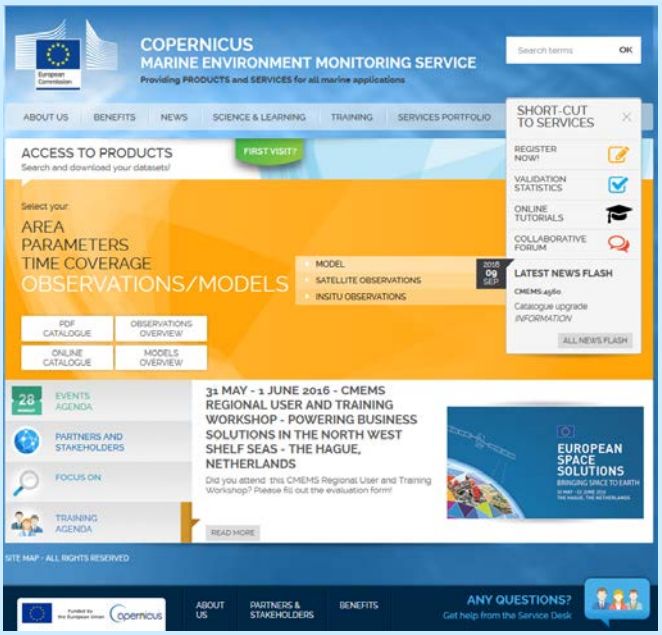
Table 7. RAIA system.

Collaboration and Information with Private Sector using Face to face and Online tools	
RAIA: The Iberian Margin Ocean Observatory	
	
Link	http://www.marnaraia.org/
Geographical scope	Regional (North Iberian Peninsula- NW coast of Spain and North of Portugal)
Fields covered	Operational oceanography; Physical oceanography; Biogeochemistry
Short description	RAIA observatory coordinates efforts between marine institutions in northern Portugal and Galicia (Spain) to observe and predict the state of the sea (currents, waves, salinity, temperature, ...) and distribute this information to the public. This is done through a portal where data from observational networks and models are made available together with the development of specific products for a number of key sectors.

Example of engagement with Private Sector (Aquaculture)	Fisheries is an important maritime sector which has great economic and social significance in Galicia. To address its demands, a modelling tool was specifically conceived and developed for barnacle collectors. Collection of barnacles depends greatly on sea conditions in rocky areas. The project started with some **high-level meetings with policy makers and advisors** from the Regional Department for Marine Affairs and Fisheries. Following the meetings, a prototype was presented to members of the aquaculture sector to learn about their preferences in terms of time span of the prediction, regions to be covered, variables of interest and so on. The prototype was then refined and a **final round of expert consultations** was held, involving again staff from the Regional government, but also scientists from research centres and the Galician Meteorological Office. Barnacle collectors can **develop their activities more safely** thanks to the modelling tool, called "Perceguru", which is available online[38]. It is interesting to note that despite the careful engagement process followed, the uptake of the modelling tool has been low. In fact, the stringent regulation currently in place, which reduces considerably the number of days where collectors can actually work, limit its impact, as there are very few periods which can potentially be dangerous. In spite of this, the initiative achieved remarkable visibility through local media probably partially due to its catchy name. The tool is also used as a reference by policy makers working at the Department for Marine Affairs and Fisheries. This also works in the interest of an increased profile of RAIA Observatory, and **it justifies its existence** to the Regional Government that supports financially its activities.

[38] http://ww3.intecmar.org/percebeiros/

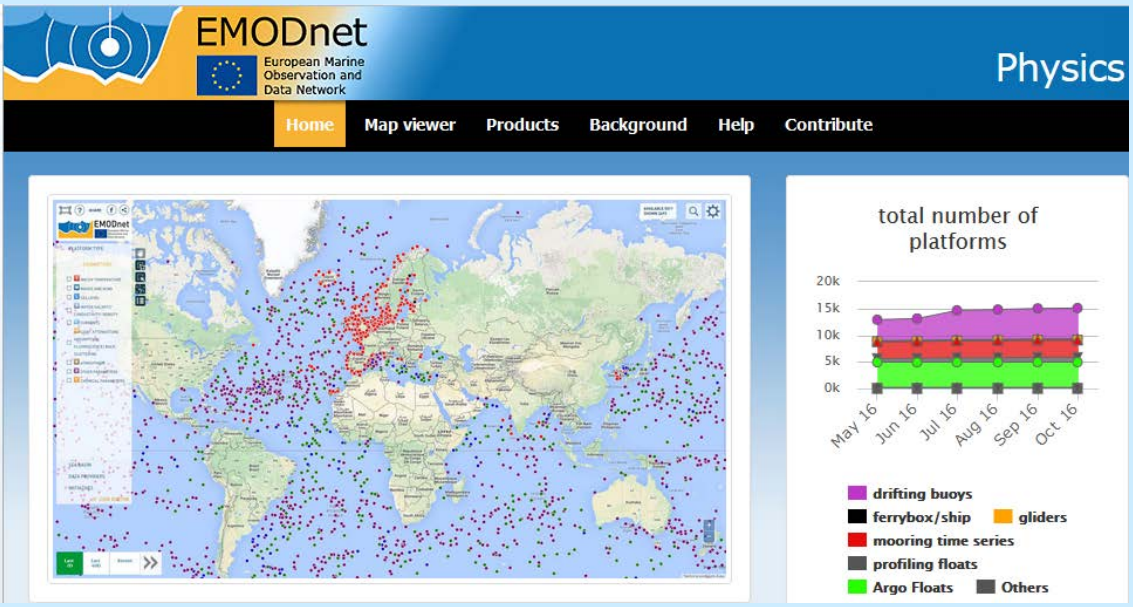
Table 8. CMEMS system.

Consultation and Information with Intermediate users using Online tools	
CMEMS: Copernicus Marine Environment Monitoring Service	
	
Link	http://marine.copernicus.eu/
Geographical scope	Global
Fields covered	Operational oceanography: mostly physical oceanography
Short description	CMEMS is an operational marine environment monitoring service. Using information from both satellite and in situ observations, it provides state-of-the-art analyses and forecasts daily. CMEMS is the marine component of the Copernicus, is the European Union funded Programme for the establishment of a European capacity for Earth Observation and Monitoring.
Example of engagement with Intermediate users	CMEMS provides an excellent example of interaction with users, done in a continuous and systematic way through their CMEMS **Service desk for users**, which has a 4-staff members dedicated team. The Service desks answers requests from users received by email during working hours. The Service also informs by email about any updates concerning new releases of products and services. Intermediate users are advanced users, who have the right expertise to take full advantage of this information and use it to improve their own products, so they are particularly keen on receiving this kind of information punctually.

	Users are encouraged to participate in the CMEMS **collaborative forum**[39] and contribute with success stories of downstream use cases to demonstrate to potential users how the products can be used. These examples are continuously published in the CMEMS web[40] and **serve to make the case** for sustaining the Service. In the webpage there is also a section devoted to training, providing access to on-line tutorials[41] covering all kind of aspects of data access, from the basic searching to the use of very specific products. In addition to the Service desk and other facilities available through the portal, **workshops** targeted to certain user communities are held regularly in different parts of Europe[42].

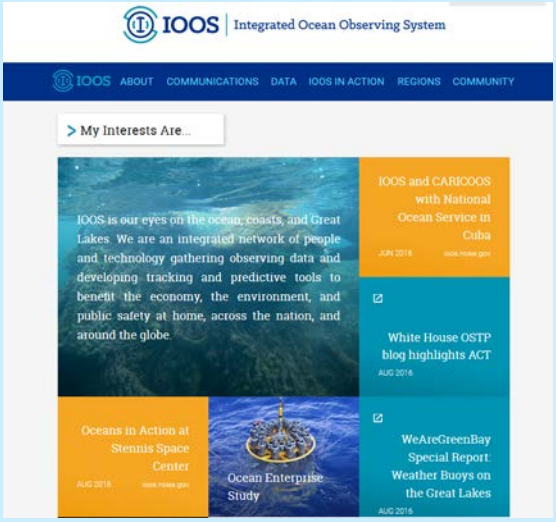
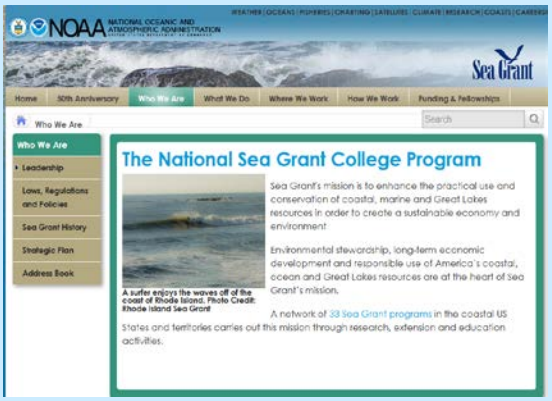
[39] http://forum.marine.copernicus.eu/
[40] http://marine.copernicus.eu/benefits/coastal-marine-environment/downstream-use-cases/
[41] http://marine.copernicus.eu/training/online-tutorials/
[42] http://marine.copernicus.eu/training/next-sessions/?keywords=Training%20sessions/

Table 9. EMODnet Physics portal.

Collaboration with Data Providers using Online tools	
EMODnet Physics: European Marine Observation and Data Network	
	
Link	http://www.emodnet-physics.eu/
Geographical scope	All European Sea Basins and beyond
Fields covered	Operational oceanography: mostly physical oceanography
Short description	EMODnet is a long term marine data initiative from the European Commission Directorate-General for Maritime Affairs and Fisheries (DG MARE). Through its Physics portal, EMODnet provides a combined array of services and functionalities to obtain, free of charge data, meta-data and data products on the physical conditions of European sea basins and oceans.
Example of engagement with Data Providers	EMODnet Physics is developing an excellent example of engagement with data providers through its Dashboard[43]. The Dashboard service is a tool that provides statistics on data availability and performance of the infrastructure behind the portal. Observing networks providing data can learn about how much data and how many platforms are available on a daily basis. They can have access to statistics regarding which are the most downloaded platforms or the origin of the download requests. This is very useful to observing networks providing data as they can **learn about the status of their networks and uptake of their data by users**, and it can act as an incentive for potential contributors.

[43] http://www.emodnet-physics.eu/Map/dashboard/

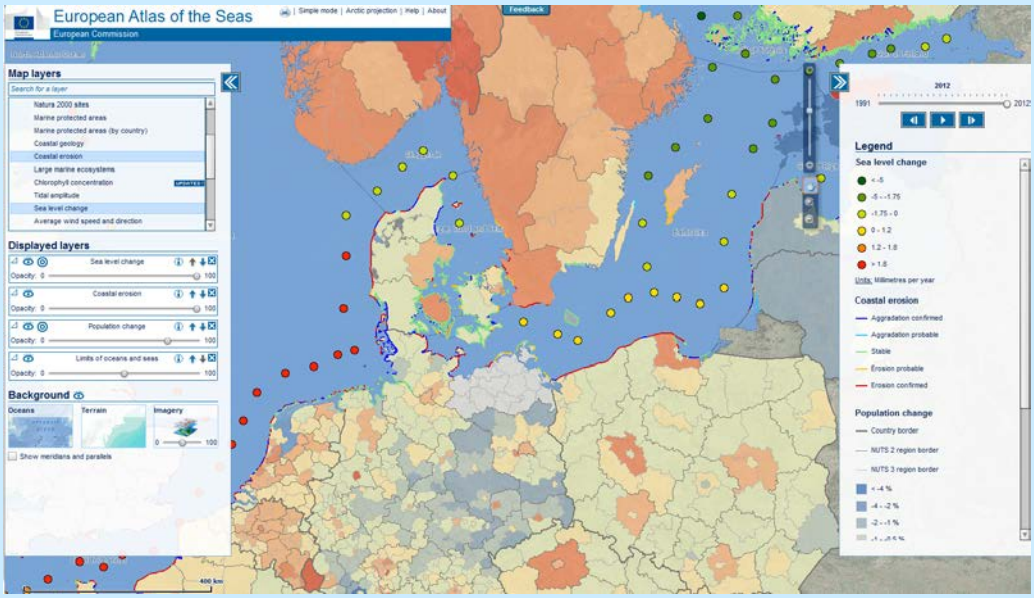
Table 10. US IOOS system.

Collaboration with Civil Society and Private Sector with multiple tools	
US IOOS: Integrated Ocean Observing System/NOAA	
	
Link	http://ioos.noaa.gov
Geographical scope	National (United States)
Fields covered	Operational oceanography: physics, chemistry, biology, geology
Short description	The Integrated Ocean Observing System (IOOS®) is a national-regional partnership working to integrate ocean, coastal, and Great Lakes observing capabilities, in collaboration with US Federal and non-Federal partners, to maximize access to data and generation of information products, inform decision making, and promote economic, environmental, and social benefits. Integrated ocean information is available in near real time, as well as retrospectively. The National Oceanic and Atmospheric Administration (NOAA) is the lead federal agency for implementation and administration of the system.
Example of engagement with Civil Society and Private Sector	A **large-scale example** of engagement with civil society is the NOAA's Sea Grant Extension (SGE) program[44]. This 50-year-running program was designed to bridge the gap between researchers and other communities (business, general public). This ambitious program is named after "Extension education", a discipline that extends university knowledge. The funding scheme is very flexible. In addition to core funds, SGE programs may be funded from a variety of sources: partial extension staff salaries and other support are often provided by state funds or from other federal agencies as well as from grants, contracts, industry, private gifts and endowments.

[44] http://seagrant.noaa.gov/Portals/0/Documents/how_we_work/outreach/extension_fundamentals_web_final-2013.pdf

	Mechanisms used in this ambitious education program are diverse, in most cases combining different types of engagement tools. The particularity of the program is that **it hires highly skilled specialists** ("Sea Grant Fellows") that act as mediators and help researchers to translate their science-based products into understandable and useful information. For instance, a project involving the Great Lakes Observing System (which is part of IOOS) takes advantage of mobile devices and internet-based technology, which have become very popular partially because it makes sharing information easier. The project has allowed recreational boaters to plan and adjust their travel on the St. Lawrence River using a new real-time and forecasting tools. Users can go to a website, identify their boating location, check on current and future conditions and sign up for email or text.

Table 11. European Atlas of the Sea viewer.

Information to Civil Society using Online tools	
European Atlas Of the Sea	
	
Link	http://ec.europa.eu/maritimeaffairs/atlas/maritime_atlas/
Geographical scope	European
Fields covered	Diverse fields including Human Activities
Short description	The European Atlas of the Seas is a freely available, web-based, interactive information system delivering collections of maps derived from data on natural and socio-economic features in the marine and coastal regions of Europe. The Atlas is provided by the European Commission, Directorate-General for Maritime Affairs and Fisheries (DG MARE). The first prototype was published in 2010. Version 1 of the Atlas was published in 2011 following a public consultation and has been updated and improved regularly since then. Version 4 will be released by the end of 2016.
Example of engagement with Civil Society	The European Atlas of the Sea was initially devised as a public outreach tool to communicate relevant marine and maritime information within and around Europe. Primarily aimed at the general public, it is also helpful to professionals in addressing environmental issues, human activities and policies related to the coast and sea (Varale et al. 2015[45]). It includes a collection of maps and associated fact sheets based on data originating primarily from the European Commission and its agencies but also from other sources.

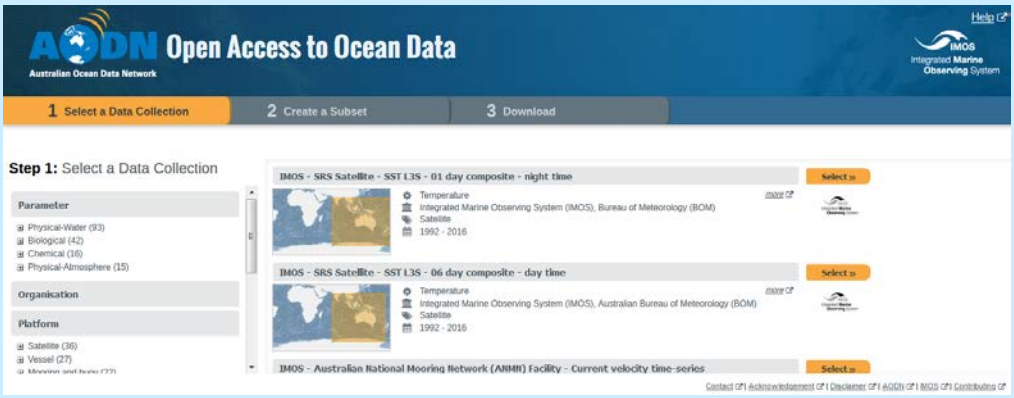
[45] Barale et al. (2015).The European Atlas of the Seas: Relating Natural and Socio-Economic Elements of Coastal and Marine Environments in the European Union, Marine Geodesy, http://www.tandfonline.com/doi/abs/10.1080/01490419.2014.909373

	The Atlas has a very simple, user-friendly interface (Atlas viewer) and it is available in French, German and English. There are thematic map layers classified under twelve main categories to represent themes relevant for Integrated Maritime Policy (e.g. geography, nature, tourism, energy…). The users can opt between a simple mode or an advanced mode. The simple mode is the one that users access by default, and they can select the theme of their interest and obtain a map summarizing all the information about that theme. The Atlas viewer in its advanced mode enables them to **overlay map layers** corresponding to different themes, with **many options for further customisation** of the final map. The map layers pane allows to choose the content, and it is possible to change the look of the individual layers as well as the map background. For instance, a user may be interested in visualizing simultaneously information concerning distribution of population on the coast, erosion rates and sea level change. Everything is very intuitive and clearly explained though a "How to use" section. Once the users have configured their personal maps according to their preferences, they can export them as images in different formats. When data are available, users can also download those. Engagement with the user is also facilitated by the Atlas team that addresses questions and comments sent through a "Feedback" button.

Table 12. COSYNA system.

Information to Scientists with a Tele tool	
COSYNA - Coastal Observing System for Northern and Arctic Seas	
	
Link	http://www.hzg.de/institutes_platforms/cosyna/index.php.en
Geographical scope	National (Germany)
Fields covered	Operational oceanography: physics, chemistry, biology, geology
Short description	COSYNA is an integrated observing and modelling system suitable for the operational and synoptic description of the environmental status of the North Sea and Arctic coastal waters. COSYNA is run as a pre-operational system, i.e., it is not experimental but geared toward a later operational use. The observations comprise a variety of in situ techniques as well as remote sensing from shore by radar and from space by satellite. COSYNA's modelling part consists of nested models with different grid sizes for hydrography (temperature, salinity, waves, currents), for suspended matter and for biogeochemical and ecosystem processes.
Example of engagement with Scientists and Civil Society	Data from COSYNA system is displayed in a **showroom** equipped with nine 42' monitors to **inform visitors and interested stakeholders in an interactive way**. This allows for a comprehensive visualization of the information provided by the observatory. For assessing the situation in the North Sea on a specific day, for example, observation data from FerryBox, Wadden Sea poles or HF radar can be displayed together with model data, resulting in a more comprehensive picture that can be better interpreted than single observations or models. This innovative and sophisticated tool can also be used for outreach activities, to present COSYNA to visitors in an effective manner and **raise the profile** of the observatory.

Table 13. IMOS system.

Information to Scientists using Online tools	
IMOS Integrated Marine Observing System	
	
Link	http://www.imos.org.au/
Geographical scope	National (Australia)
Fields covered	Operational oceanography: physics, chemistry, biology, geology
Short description	IMOS is designed to be a fully-integrated, national system, observing at ocean-basin and regional scales, and covering physical, chemical and biological variables. IMOS is oriented to the science community and its observations are guided by science planning undertaken collaboratively across the Nodes of the Australian marine and climate science community with input from government, industry and other stakeholders. IMOS observational platforms include Argo floats, moorings, gliders… as well as satellite remote sensing.
Example of engagement with Scientists	The Australian Ocean Data Network 123 AODN Portal (http://portal.aodn.org.au) provides an **online multi-purpose platform** which allows marine and climate scientists **to discover, explore, access and download** all IMOS **data streams**. The portal has been designed to strictly adhere to the three-click rule so that the user is capable to reach the dataset of interest in just three steps: select, create and download. The fact that the portal is oriented to experts makes this feasible, as they must know clearly what he is looking for: parameter, time span, location. In November 2014 they included faceted menus to group their free, online data collections into related, intuitive classifications. Obviously, the ease of use attracts more users who can **save a considerable amount of time**. On the other hand, in order to **make specialised data more usable**, the AODN staff and Facilities have developed a number of **data tools** over the years. For each IMOS Facility, brief descriptions of these attractive data tools are provided along with relevant links[46].

[46] http://imos.org.au/imosdatatools.html

5 DATA PORTALS AS AN ENGAGEMENT TOOL

5.1 Introduction

Data portals can be considered as multipurpose platforms where many of the engagement mechanisms described in previous sections can be effectively implemented for the benefit of a wide range of stakeholders, whether they are internal or external, providers or users. They are one of the core tools that enable ocean observatories and observing systems to interact with their stakeholders at different levels of engagement, from simply informing them to getting them involved in various ways (see Section 2.1).

In its simplest terms, a data portal is a web page that acts as an entry gate for users seeking access to datasets. Since marine datasets are the most important outputs from ocean observatories, data portals are a critical tool to establish a durable relationship with stakeholders. Not surprisingly, many of the AtlantOS partners who are creating, managing and storing marine datasets and associated metadata are already making these available via a range of data portals. But ocean observatories often also generate products, information and ultimately knowledge using the data they serve, and these can also be made available to users through a data portal. Finally, ocean observatories may provide different kinds of services to their users, such as, for instance, consultancy or technical services, training etc., which can be advertised via portals.

The AtlantOS Engagement Strategy states that "*While focusing on concrete outputs and services, the strategy takes a value-chain approach, by which all outputs and services will be conceived in terms of their contribution to developing stronger interactions between the scientific community as the supplier of products and services, and the various demands of industry, government and broader society*".

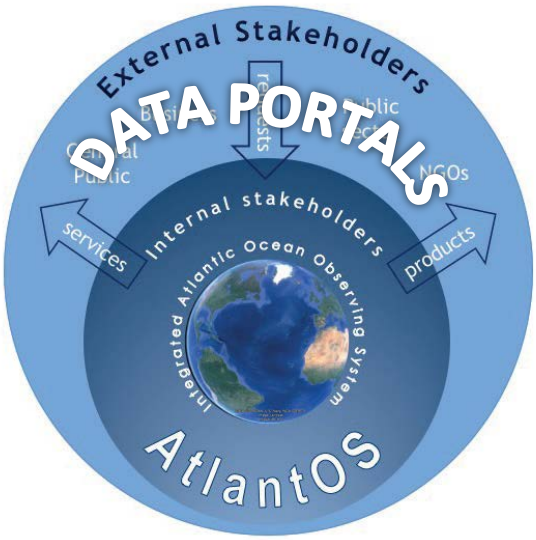


Figure 5. Diagram showing the role of data portals in the value chain from scientists (internal stakeholders) to users (external stakeholders). Adapted from the AtlantOS Engagement Strategy.

5.2 What makes a data portal engaging?

5.2.1 Friendly and useful data portals

As depicted in Figure 5, data portals can be considered as the visible face of the observatory, the interface between scientists and users, and hence should be as user-friendly as possible, so that the outputs of the observatory can reach their target users and meet their requirements.

The portal concept is to offer a single website that aggregates contents from several systems or servers making it easier for the user to find data, information or other resources in one place instead of having to harvest information from different sources. This aggregation can be more or less sophisticated so that a user can be encouraged or deterred by the technical characteristics of the portal, before actually finding the data and developing an opinion on their quality. The importance of data portals for the success of ocean observatories cannot be underestimated, and this success will depend greatly on how "engaging" its data portal is. Engaging data portals will have recurrent users who will (i) be attracted by the portal's **friendliness** and (ii) be satisfied by the **usefulness** of data, metadata and derived products they find.

The concept "friendliness" refers to the personal, more subjective experience of the user while visiting the portal, which is independent from the data themselves. On the other hand, a data portal will be useful if it succeeds to provide users with the data they need in the way they need it. The choice of the word "useful" is not arbitrary, as it ensures that the users perspective is considered foremost. In addition, the concept "usefulness" has a specific meaning in this context as it relates to the vocabulary adopted by the EMODnet Checkpoints[47] in their methodology to assess the fitness for use of marine datasets to face selected societal or economic challenges[48].

[47] www.emodnet.eu/checkpoints
[48] http://www.emodnet-mediterranean.eu/wp-content/uploads/2015/06/D11.2-revised-V11.pdf

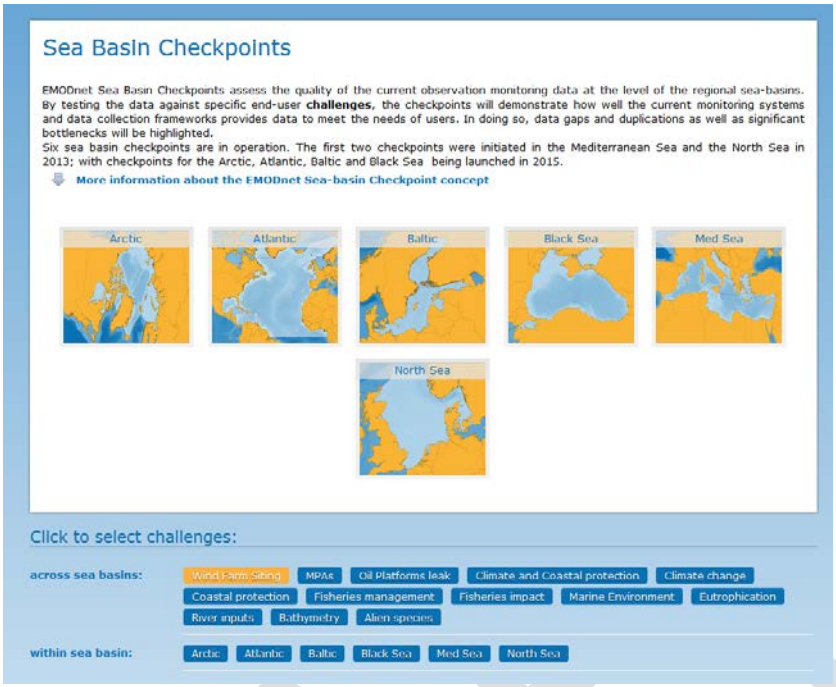


Figure 6. Snapshot of the entry page to EMODnet checkpoints data portals.

Taking the perspective of a user, the criteria used for the appraisal of a portal may vary depending on the type of user. This relates back to stakeholder categorization and descriptions proposed in Section 3.2, as different users will have different requirements and expectations and, in fact, understanding that "one size does not fit all" is very important when conceiving a data portal. Nevertheless, it is still possible to identify certain common features or attributes that appear repeatedly in the literature and which have an impact on the experience of all types of users when using data portals. These attributes determine the engaging capacity of the portal, first to attract users, then to satisfy their expectations in terms of data, products, services or information required and finally to foster their loyalty so that they become recurrent users. Some of these attributes can be assessed in a measurable way, through indicators (generally technical aspects), whereas some other attributes may be more subjective (visual appeal, for instance). On the other hand, there are certain attributes that acquire particular relevance when focusing specifically on marine data portals and not just data portals in general.

Marine data portals with high engaging capacity will likely have many users and in the sections below, we aim to identify the most important factors that contribute to that capacity. To this end, we will develop a list of key features (attributes) and we will illustrate with an example how these attributes can be used to describe data portals, and potentially evaluate their engaging capacity.

5.2.2 *Key attributes to consider the engaging capacity of Marine Data Portals*

To determine the attributes which are relevant for the appraisal of data portals capacity to engage users satisfactory, we have to take the user's perspective. This will be done in a systematic, comprehensive way, with a step-by-step approach, following his experience and reactions while visiting a data portal. Each step will relate with a **relevant, distinct element** of the user's visit. Considering the chronology of such an visit, the following temporal sequence could be envisaged:

STEP 1 : Visual impression The user will form an initial impression when accessing the portal. This will be based on the visual perception, and to what extent the layout is appealing or not. This can be a very subjective feeling and it is not straightforward to please all visitors, as they may have different tastes when it comes to colours, fonts, sizes and so on. In any event, visual aspects clearly matter as they can condition the user experience while navigating through the web page. An interesting revision of some basic principles concerning layout can be found in the report “Interface Design Strategies for Data Portals”. The authors mention that “it bears reminding that data portals have the purpose to showcase the data that they contain and not as much the organisation behind them; though a simple principle, we find that it’s very often ignored in the real world.”	
STEP 2 : Navigation Depending on how the contents are distributed, and regardless of the general layout, the amount of time the user will have to spend in order to find the required dataset, product or service will vary. It is at this point that the user may feel frustrated and discontinue his search, should the dataset/product/service not be easily accessible. As for the previous step, there are no magic formulas that ensure a satisfactory experience for all and this can be subjective to a certain extent. Nevertheless, a simplified access is generally recommended and the 3-click rule often mentioned: The user should be capable of finding what he needs after only three clicks from the main page.	
STEP 3 : Data availability After the data set has been identified, the following step concerns getting access to the data: downloading the times series, plotting a map or visualizing the animation in a reasonable amount of time. Once again, this can bring about some irritation if it is too difficult or it takes too long. For instance, the users may be prompted with a complex registration process before they are given access to the data. Or he may have to pay a fee. And even if the data are for free they may take too much time to download simply due to technical limitations. Another aspect concerns how reliable the system is, that is to say, how often it can experience failures that impede access to the data.	
STEP 4 : Data appropriateness Once the user gets access to the data, they will have a better view on how good the data really are, that is to say, to what extent they are appropriate to fulfil their needs. Part of their satisfaction will obviously depend on that too. Data that present significant gaps, or outliers, or do not have the accuracy and precision that the user expect are likely to bring about frustration. That perception can derive from a direct impression (when he has a look at the numbers, maps, figures...) but it can also be supported by the metadata that can be also accessible together with the data. In fact, users can first consult metadata information before deciding to download the data. Metadata can be particularly important for certain types of users, such as scientists.	

STEP 5 : Interaction with the portal Ultimately, the user may wish to interact with the portal, asking for help, providing feedback, participating in a discussion group… They may also be interested in operating further with the data when the portal offers advanced functionalities so that they can, for instance, obtain some basic statistics or make their own maps by superposing layers. This will increase the possibilities of maintaining the relationship with the user in time and ensure that they become a recurrent user, spending more time in his visits, making the data portal more successful.	

The following summary clarifies the choice of terminology:

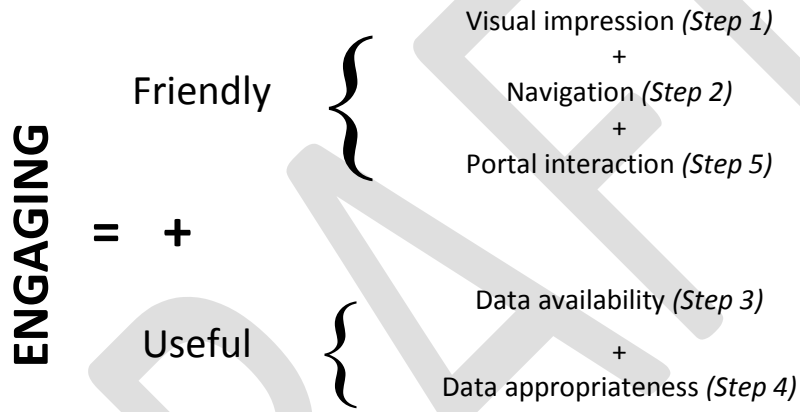


Figure 7 Choice of terminology linking the reasoning offered in Section 5.2.1 with the element/steps describing the data portal user's experience.

We will now attempt to give more insights about each of the elements contributing to data portal's engaging capacity, by specifying and describing attributes related to them. In addition to the previous elements which follow a temporal sequence, another element specific to portals serving ocean observatories must be considered. This element includes features of relevance for users of outputs such as the ones that could be provided by AtlantOS and the future Integrated Atlantic Ocean Observing System. In consequence, it takes into account the current composition of the partnership and networks currently contributing to the project. Finally, we suggest to add a miscellanea group which includes a number of attributes that may be worth considering even if they do not fit clearly in any of the previous steps or are in a way transversal to all of them.

The complete breakdown of those elements into attributes of relevance is provided as a list in *Table 14*. The list of attributes and their description are largely based on information, methodology and vocabulary employed by a number of specific reports, websites and relevant initiatives:

- List of System Quality Attributes in Wikipedia, which provide a general overview that can be adapted to Data Portals (if we consider Data Portals as "systems")

- A research paper from Moraga et al. (2006)[49], which examines several models to determine which aspects are important for the quality of a web portal
- The recent report "Interface Design Strategies for Data Portals"[50] providing very useful and practical insights on how to improve the clarity and usability of data portals
- Datasets Quality elements in the EMODnet MedSea checkpoint methodology[51], which applies to datasets, not to data portals, but many of the concepts are useful. In particular, when talking about fitness for use of a dataset, MedSea checkpoint defines two "territories": availability and appropriateness, and these concepts are adopted here.
- The results of the first EMODnet portals evaluation (internal documents and personal communications) as well as the results of the AtlantOS survey (Annex 1. Stakeholder Engagement Survey) have also been taken into account
- Finally, some inspiration was found in the list of indicators proposed in the European Data Portal Project Insight report[52], which provided insights into the European state of play for Open Data Portals

More in particular, attributes describing steps 1 and 2 (Visual identity and Navigation) are fundamentally based on the ePSIplatform Topic Report, while steps 3 and 4 (Data availability and Data Appropriateness) use the methodology and vocabulary developed in the EMODnet Mediterranean Seabasin Checkpoint.

Whilst efforts were made to be as exhaustive as possible when considering the data portal user's experience in order to define the seven general elements (one element per step, plus the group specific to ocean observatories plus the miscellanea group), the final breakdown into attributes required some selection and simplification, so that using them remained feasible. Hence, the list proposed in *Table 14* aims at being comprehensive and manageable, but it is not final, let alone definitive.

Table 14. List of attributes of relevance when considering marine data portal engaging capacity.

Data Portal Attributes	Description
Step 1: VISUAL IMPRESSION	*Appearance may be deceptive, but matters. A good first visual impact can be crucial to attract visitors and to keep them navigating*
Appeal	this attribute can incorporate elements like originality, sobriety, design consistency. It may be personal, but very important
Visual hierarchy	content is highlighted using different sizes, colors, positions, fonts to draw visitor's attention toward certain items
Typography	text should be comfortable to read, have a reasonable variety of fonts to avoid boredom etc.

[49] Moraga et al. (2006). https://www.researchgate.net/publication/220207642_Comparing_different_quality_models_for_portals
[50] https://www.europeandataportal.eu/sites/default/files/2015_interface_design_strategies_for_data_portals.pdf
[51] http://www.emodnet-mediterranean.eu/wp-content/uploads/2015/06/D11.2-revised-V11.pdf
[52] https://www.europeandataportal.eu/sites/default/files/edp_landscaping_insight_report_n1_-_final.pdf

Step 2: NAVIGATION	*Users should be able to identify the shortest path to the data they are searching for, and find them as fast as possible*
Language clarity	vocabulary is adapted: not too technical jargon, explanations if needed
Structure	a complex internal data structure should not reflect be reflected in the data presentation, which should have an intuitive, logical structure
Simplicity	non indispensable elements avoided, reduced number of clicks
Guidance	guiding explanations: inclusion of FAQ section, tutorials….
Step 3: Data AVAILABILITY	*Data portals can make available data sets, products and services in various ways, and this impacts users' experience*
Data access services	discovery, searching, filtering, viewing, downloading…
Data policy	restricted, with moratorium, immediately accessible
Pricing policy	from cost charges applying to available for free
Formats	different data formats available
Interoperability	web on-line services interoperability (OCG standards: WFS, WMS...)
Responsiveness	ability to process a request in a certain amount of time
Reliability	portal not failing and accessible from common web browsers
Step 4: Data APPROPRIATENESS	*To what extent the data available to the users meet their expectations and fulfils their needs?*
Spatial/Time extent	geographic/temporal maximum boundaries
Spatial/Time resolution	size of the smallest interval of distance/time resolved by data
Completeness	degree of absence of excess of data in a dataset
Accuracy	positional accuracy, temporal accuracy, thematic accuracy
Metadata	accurate, complete metadata
Step 5: INTERACTION with the portal	*Two-ways communication proves effective to attract users back to the portal*
Advanced Plotting/Mapping	possibility of manipulating data and creating your own products directly through the portal (without previous downloading)
Help features	possibility of getting assistance (info email, 7d/24h helpdesk services…)
Feedback	possibility of making comments, suggest improvements
Info about the portal	possibility of receiving info on portal upgrades (news section, by email…)
Attributes relevant for OCEAN OBSERVATORIES	*Data portals serving Ocean Observatories have their own specificities and some features can be particularly important for users*
Spread of data across relevant domains	data spreading multiple areas of knowledge or fields

Spread of data across measuring devices/platforms	e.g. vessels, buoys, gliders, drifters, radars…
Type of outputs provided (1)	time series, plots, animations…
Type of outputs provided (2)	real time, delayed mode, historical…
Type of outputs provided (3)	in-situ, satellite, models…
OTHER ATTRIBUTES	*This is a miscellanea and expandable category, comprising other relevant features not falling in any of the previous ones*
Several languages	crucial for the some users, irrelevant for others. English is essential for any portal with more than local remit.
Social media	access to facebook, twitter, linkedin…
Access from other devices	possibility of operating from tablets, mobile phones…
Entry profiles	pre-defined user profiles leading to different web pages…

5.3 Using attributes to assess the engaging capacity of a data portal – an example

5.3.1 Aim and approach

The aim of this section is not to do an evaluation itself, but rather to suggest a possible approach to assess the engaging capacity of a data portal, estimate the potential as well as the limitations of the approach and suggest ways to improve it. To this end, the list of attributes presented in *Table 14* is applied to a data portal serving an imaginary ocean observatory, OCEANUS[53]. OCEANUS relies on an extensive ocean and coastal monitoring network, including buoys, tide gauges, HF radars etc. The system also provides ocean forecasts for currents, sea level and waves. Physical oceanographic data from the monitoring networks and models are processed, managed and made available to its main stakeholders (harbours) and the general public by means of a data portal.

The assumption is that the attributes listed in the table allow a description of a data portal covering all relevant elements that can contribute to making it "engaging". In addition to that, the test exercise reveals certain practical difficulties that can arise during the evaluation. This provides insights about the pertinence of certain attributes, how objectively they can be assessed, their relative importance depending on the type of user and scope of the data portal etc. In summary, the exercise will serve as a mean for further refinement of the evaluation method.

5.3.2 Results of the scoring exercise

A score is assigned to each of the listed attributes from 1 (poor) to 5 (excellent). A score of 3 would mean that the data portal is average when rated for this attribute, and 0 that the scoring is not applicable or that it is not possible to provide a score.

[53] OCEANUS does not exist as such, but it is heavily inspired by a few existing initiatives

Table 15 contains the list of attributes and the scores assigned to each of those attributes by an evaluator after using the imaginary data portal. Together with the scores, the table includes some comments/remarks made by the evaluator. These comments serve to justify/qualify his scores as well as to refer to the difficulties he encounters when doing the evaluations.

Table 15. Text exercise scores and comments.

Data Portal Attributes		
Step 1: VISUAL IMPRESSION	Scoring	*Comments*
Appeal	4	Attractive layout, choice of colors, images, some original elements…
Visual hierarchy	3	Important elements are identified easily for their position and there are not distractive elements
Typography	4	The size by default is small, but there is a menu to change it and make visualization more comfortable
Step 2: NAVIGATION	Scoring	*Comments*
Language clarity	4.5	The wording is clear and simple
Structure	5	It is very easy to understand where to go
Simplicity	3.5	The number of intermediate steps seems reasonable
Guidance	2	Few explanations provided
Step 3: Data AVAILABILITY	Scoring	*Comments*
Data access services	2	Downloading is not possible, this is a major limitation even if the other services (discovering, visualizing, filtering) work OK
Data policy	0	This attribute is not applicable since we cannot download data through the portal!
Pricing policy	5/0	Visualization, filtering are for free (but this is not surprising). Nevertheless, this attribute loses meaning since downloading is not possible, so the scoring here is tricky, 5? 0?
Formats	0	This attribute is not applicable since data cannot be downloaded through the portal.
Interoperability	0	Same comment as above
Responsiveness	5	Accessing the data is instantaneous, without delays
Reliability	5	The portal seems very robust. It has never failed in all the times visited and works fine from most popular web browsers
Step 4: Data APPROPRIATENESS	Scoring	*Comments*
Spatial/Time extent	5	Not easy to evaluate globally without having a concrete application in mind. Nevertheless, given the type of network it is based on (good coverage, functioning since several years), one would expect

		that the spatial and time extent is as good as it could be, hence the high score
Spatial/Time resolution	3	Here the reasoning could be the same as in the attribute above. However, since it is not possible to download the data, the time resolution, for instance, is limited (because the visualization in charts makes it senseless to show high-frequency data), hence the lower score
Completeness	4	Time series present some gaps, but they seem always lower than a 20%
Accuracy	5	This scoring is based on the fact that networks are using recent technology, so we presume that the accuracy will be up to the most recent and exigent standards
Metadata	3	Some ancillary information about instruments, measuring stations and so on is provided: enough, but not very abundant
Step 5: INTERACTION with the portal	Scoring	*Comments*
Advanced Plotting/Mapping	2	No, there is no room for advanced manipulation of data beyond making zooms and things like that
Help features	3	Not assistance available beyond an info email address
Feedback	2	There is no clear indication as whether it is possible to ask questions or give opinions
Info about the portal	1	There is a small news section, but it is very generic
Attributes relevant for OCEAN OBSERVATORIES	Scoring	*Comments*
Spread of data across relevant domains	3	It's only physical data, but that is the purpose of the portal and the number of variables presented is reasonable
Spread of data across measuring devices/platforms	4	Instruments providing data to the portal are remarkably varied
Type of outputs provided (1)	4	Different types of charts, plots, maps, animations
Type of outputs provided (2)	3	Real time and delayed mode Ok, but historical time series are only accessible on reports
Type of outputs provided (3)	4	In-situ and models
OTHER ATTRIBUTES	Scoring	*Comments*
Several languages	3	National language + English, so, average score
Social media	1	Links to facebook and twitter not working!
Access from other devices	3	Access from mobile phones work well, but from tablets it is not that good

5.3.3 *Limitations and potential of the method*

The application of the evaluation method has revealed a number of pitfalls, described below together with possible ways to overcome them. Considering first the evaluation of attributes related to the concept "friendliness", the main difficulty lies in the subjectivity of the evaluation, since tastes and perceptions can be very personal. And yet, giving opinions (even if they can be arbitrary to a certain extent) can be far easier than giving objective scores (for instance, by means of defining and applying indicators). In this respect the advantage would be that judging these features could be done almost at first sight so this could also mean that the evaluator task would be less heavy. More evaluators would allow the establishment of something akin to a "Tripadvisor" for data portals whose strength would rely not in the fairness of the evaluation, but on how homogeneous evaluations are.

On the other hand, some of those attributes can, in fact, be quantified (even though in our test we have not tried this approach). For instance, we could argue that the attribute "Simplicity" can be assessed by actually counting the number of clicks required to get to a certain objective. Or we could count the number of different fonts/sizes to evaluate the attribute "Typography".

The second type of elements are related to data (Data availability and Data appropriateness, Steps 3 and 4), and in many cases some indicators could be defined to score them. For instance, spatial and time extent, resolution, accuracy… they are all attributes that can be easily measured. However, even if quantifying the attribute "accuracy" is possible, deciding whether this value is good or bad and applying a score can still be difficult, because that decision will depend on the application. For instance, a 10 cm accuracy level in tide gauge data can be more than enough for harbour operations, but may be insufficient for climate change studies. So different users can have different appreciations on the same objective value.

In practice this could be solved by defining a concrete task for the evaluator to undertake, so that he bases his appraisal in that application in particular. This is the approach practiced by the EMODnet sea-basin checkpoints when assessing the suitability of certain datasets to face concrete challenges. Other possibility would be to compare that attribute with the best possible value given the current state of art.

A second difficulty related to the type of users is that the relevance of each attribute contributing to the data portal "engaging capacity" is also user dependent. For instance, aspects related with step 4 of the process (data appropriateness) will be more important for a scientists who validates a model with real time data, than for a citizen who is simply curious about environmental conditions near his favourite beach. On the contrary, the latter will be more sensitive to the visual aspects, appreciating that information is presented in an attractive way. Extending this thinking further and considering a specific attribute, for instance, the pricing policy, affording a fee will be better accepted by a professional working for the private sector than by a civil servant working for a public body. In consequence, the latter will probably consider that attribute more limiting for his work.

One solution to these limitations would be assigning user-dependent weights to the attributes before obtaining a final mark in the evaluation. Obviously, this is not straightforward and may make the method too cumbersome, but one possibility would be to use the results of the AtlantOS Survey on Stakeholder Engagement to assign weights. The survey presented a final section about factors of success for marine data portals. Participants were presented with a simplified list of attributes based on *Table 14* (see Annex 1 for details) and asked to rank them according to their relevance. The survey shows, for instance, that "Ease of use" (meaning a smooth navigation) is considered essential,

whereas “In-portal data plotting” is the less relevant attribute and this is so for all kind of users. Scores in general do not vary much across the different profiles/parent institutions and they must be interpreted with caution given the unbalanced composition of the sample (a majority coming from University, less working in Public Bodies and Private sector and very few in NGOs). But with the right sample size a reliable weighting could be established.

In spite of all those limitations, the proposed evaluation method can be very helpful to describe marine data portals in a systematic, comprehensive way. This approach could be used by project leaders, for instance, to do a self-assessment of their project data portals and identify areas of improvement. If carefully designed, the list of attributes can be used to compare data portals and estimate how friendly and useful they are. As described, this will require a clear previous definition of the type of user and application that the data portal must serve to adapt the list accordingly, adding or eliminating attributes and assigning weights to them.

6 REMARKS AND RECOMMENDATIONS: THE WAY FORWARD

This section condenses the most important findings contained in this deliverable regarding how ocean observatories can engage successfully with stakeholders, and more in particular how they can better serve their users delivering data, products and other services to them through data portals. The findings are presented in the following table (Table 16), together with some recommendations of best practice, which can be considered by AtlantOS for implementation within and beyond the project, in particular to strengthen work in WP7 and WP11 and feed into Task 10.3.

Table 16. Stakeholder engagement process: general remarks and possible actions recommended for AtlantOS.

	REMARK	**RECOMMENDATION**
1	Stakeholders engagement is a key factor for a successful project development of project and the future sustainability of ocean observatories. Engaging stakeholder adequately requires analysing some crucial elements of the engagement process: the WHY (benefits of engaging), the WHO (stakeholders identification), the HOW (selecting the tools for engagement) and the WHEN (when to use those tools).	Invest sufficient resources to consider and analyse in depth the core elements of stakeholder engagement (WHY, WHO, WHEN and HOW) as early as possible. An initial assessment of these elements for AtlantOS is embedded in this report and other work within Work Package 10 (Engagement, Dissemination and Communication), but this should be further expanded as a basis for durable engagement in the future Integrated Atlantic Ocean Observing System.
2	Identification of stakeholders (i.e. analysing the WHO) is particularly relevant. Clarifying who are the users and understanding their needs will help establishing priorities as how to proceed with the engagement process when resources are limited.	Perform a comprehensive stakeholder mapping to successfully engage them. Such a mapping should provide an overview of the stakeholders, their importance for the observation system, their practices, needs, interests and expectations. This should also include the identification of a number of

		priority/target groups taking into account available resources.
3	The engagement process must be conceived at the very early stages of the process as clearly as possible but not rigidly. Roles of stakeholders with respect to the project are likely to vary throughout its lifecycle.	Develop a flexible approach to the engagement process, so that updates and adaptations are possible as the project evolves.
4	Data providers must understand the advantages of contributing data instead of considering it as an extra workload.	Always ensure that data providers are visible and datasets well documented with metadata providing information about the provider. Creating Digital Object Identifiers for datasets would also be recommendable. If resources are available it is recommended to offer technical assistance and training to ease provision of data. All benefits for data contributors should be clearly visible on the data portal.
5	Data providers appreciate obtaining information about the actual usage of their data. This can both serve as a motivation for contributors and as an incentive for potential ones.	All data portals should have a 'Dashboard' section on their webpages. Dashboards are easy to read, often single page, real-time user interfaces, showing a graphical presentation of the current status and historical trends of a project progress (e.g. EMODnet Physics[54]).
6	Successful engagement with the private sector and adequately meeting their needs occurs most commonly when there is a close link between users and developers. The user must participate in the process of developing the product from the onset and throughout; the developer must be capable of incorporating user's views and adapting the product. In some cases this will also require investing time in training, to ensure the correct uptake. This may be beyond the capacities available within an individual ocean observatory but should be available in larger observation systems.	In terms of users' involvement in development of products there are different options: • Make available resources to establish early contact with potential users to learn about their needs. Conceive and develop products that can meet those needs. Offer a first prototype so that an iterative process can be initiated to get to the final product. • Do not develop products, but focus on intermediate-users who in turn will develop tailored products using data provided by the observatory. • A combination of the above: involve stakeholders in the prioritisation, selection and development of demonstration products.

[54] http://www.emodnet-physics.eu/Map/dashboard/

		At the same time, clearly delineate the products that can be developed with public resources and those which would be better developed by intermediate users.
7	Data portals are used by ocean observatories to disseminate and visualize data, metadata and products, and to provide services to their users. As such, they are a key tool to engage with stakeholders. Their capacity to attract visitors (how engaging they are) depend obviously on their usefulness, but also on their friendliness. While primarily conceived by and for scientists, who may be more concerned about the usefulness aspect, these are not the only community who can use marine data portals. Good quality data and products are a prerequisite but does not necessarily imply that they will be widely used: they need to be adequately presented.	Ensure best possible user experience by providing an intuitive navigation structure on a well-designed, well-structured portal is of great importance and resources must be dedicated to this. This may imply relying on professionals if needed.
8	Data portals can have very different types of visitors with different expectations and requirements. In some cases it may be difficult to satisfy all users' needs with one single layout if the requirements differ greatly.	If there is one clear target group, or if the requirements and expectations of different users are sufficiently similar and well-known, it is recommended to develop the data portal in a "specialized way", tailored to better meet the expectations of the target and/or priority groups (e.g., scientists in the case of IMOS[55]). If there are several clear target group with distinct requirements and expectations and if there are sufficient resources available, it is recommendable to develop the data portal so that users when identifying themselves are redirected through different pathways or modules/interfaces depending on their preferences (e.g. see Perseus[56] project webpage according to profiles or Marine Data Portal[57] according to fields of interest).

[55] https://portal.aodn.org.au/
[56] http://www.perseus-net.eu/site/content.php
[57] http://data.marine.ie/

9	Data portals can benefit enormously from developing a reciprocal, interactive relationship with users through their data portals. Users may be keen on expressing opinions and preferences about the data and products they find in the portals. They may also want to express their demands and concerns, as well as to ask questions related to the them.	Setting up forums or helpdesks with an adequate investment of resources, e.g. with dedicated staff who can address users' comments in a proper way and do the follow up (see Table 8. CMEMS system.).
10	It is important not to raise expectations among data portal users that cannot be met because it causes frustration in the user who may feel deceived. This can apply to the data appropriateness (its accuracy, time span, etc.) but also to their availability (datasets that are shown but are finally unreachable and so on).	Be candid about limitations. Using Beta versions or simply include clear explanations together with the datasets to explain their limitations in terms of quality or access.

ABBREVIATIONS AND ACRONYMS

CMEMS	Copernicus Marine Environment and Monitoring System
DG MARE	European Commission Directorate-General of Maritime Affairs and Fisheries
DG RES	European Commission Directorate-General for Research and Innovation
EMB	European Marine Board
EMODnet	European Marine Observation and Data Network
EOOS	European Ocean Observing System
ERA-NET	European Research Area Net
EuroGOOS	European component of the Global Ocean Observing System (GOOS)
JPI Oceans	Joint Programme Initiative Oceans
GEOSS	Global Earth Observation System of Systems
GMEMS	Global Monitoring for Environment and Security
GIS	Geographic Information Service
HF radar	High Frequency Radar
MSFD	Marine Strategy Framework Directive
MSP	Maritime Spatial Planning
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
OECD	Organisation for Economic Co-operation and Development
OGC	Open Geospatial Consortium
ODP	Ocean Data Portal
QA/QC	Quality Assurance/Quality Control
SME	Small and Medium-sized Enterprises
WFS	Web Feature Service
WMS	Web Map Service

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ANNEX 1. STAKEHOLDER ENGAGEMENT SURVEY

Sample description

- Participation rate: **89** participants (out of 170 contacted)
- Participants providing extra input on Engagement Tools: **38**
- Participants providing extra input on Data Portals: **60**

	YES	NO
Is your organisation a partner in AtlantOS?	63	26
Is engaging with stakeholders a relevant part of your duties (i.e., represents more than 20% of your working time)?	48	41
Should intermediate users be a priority stakeholder for AtlantOS?	77	12

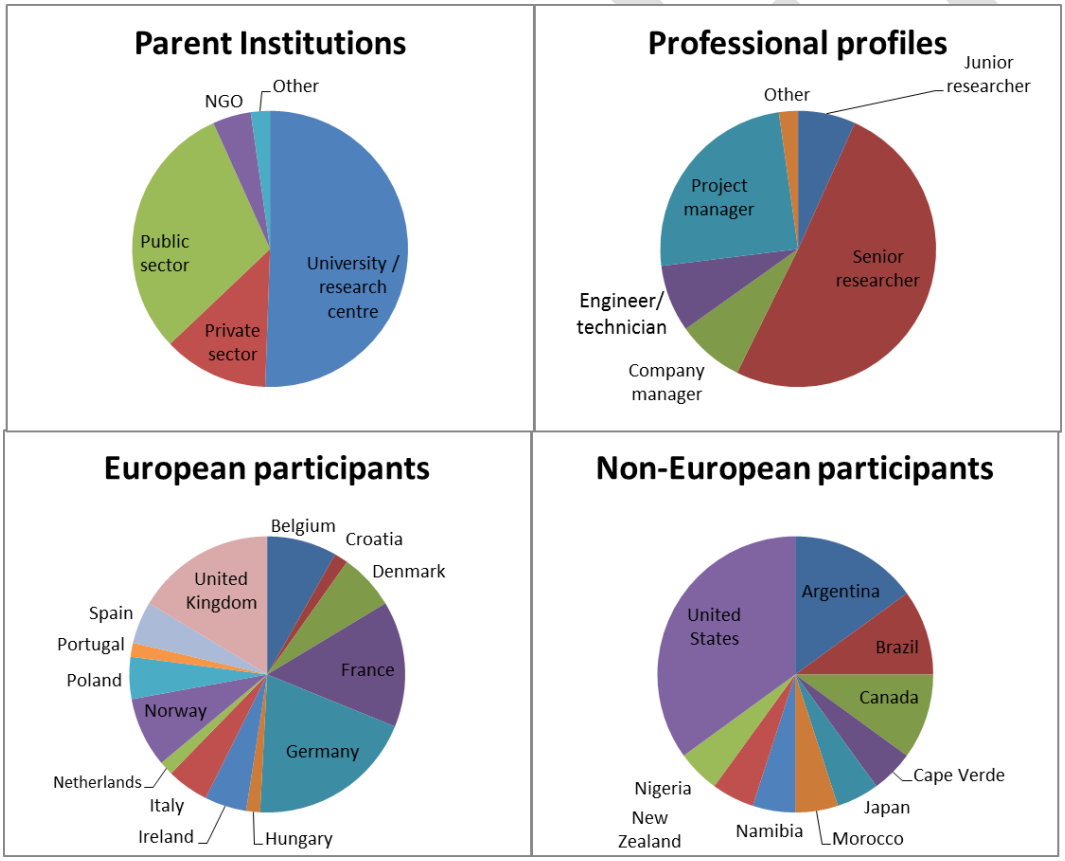

Figure 8. Distribution of participants in the survey according to their parent institutions, professional profiles and origin (total number of participants = 89)

Online Questionnaire

AtlantOS stakeholder engagement survey

Introduction

Context and objectives

AtlantOS proposes the integration of ocean observing activities in the Atlantic to obtain a more sustainable and fit-for-purpose system. Engagement with stakeholders including users of AtlantOS products and services, is key throughout the project. Task 10.2 of the project aims at getting a better understanding on how to efficiently engage with stakeholders, attract more users and identify ways to improve usage of data and information from observatories.

With this questionnaire we would like to get your feedback on: 1) your experience on engaging with stakeholders, and 2) your views on how this should be done within AtlantOS. This will complement a desktop study already undertaken for this task and may be used to formulate recommendations of best practice.

A couple of definitions before we start...

Stakeholder engagement can be described as an organization's undertakings to understand and involve stakeholders and their concerns in its activities and decision-making processes.

By stakeholder we understand this to be a person or any entity that may be affected, impacted or have any interest in the organization or in the outputs produced by the organization - either directly or indirectly. This general definition can include a wide range of individuals/entities, including stakeholders internal to the organization who generate outputs. However, for the purposes of this questionnaire, we will focus on those stakeholders who are users of those outputs.

We will ask you to respond taking into account your current professional activities within your organization as well as your opinion about engaging with users in the framework of AtlantOS. Where we ask for your opinion, please reflect your own personal views rather than presenting the view of your organisation.

The questionnaire has several parts: in the first part we gather information about you and your organization. The second part deals with identifying and prioritising stakeholder groups, and leads to sections on the benefits of stakeholder engagement and the different types of processes (both for your own work and for AtlantOS). The last section focuses on data portals as an important tool to engage with users.

All personal data collected in this questionnaire will be used only in connection with this survey, will be stored securely and will not be passed on to any third parties.

The closing date for responses is 15 August 2016.

Any questions? Please contact Belen Martin-Miguez
e: belen.martin-miguez@seascapeconsultants.co.uk
p: +32 (0) 59 341429

Part 1: About you

1. Your name

2. Please enter your email address
(We will use this only in connection with this survey, and will not pass it on to anyone else)

3. Which organisation do you work for? *

4. Which of the following best describes your organisation? *

- University / research centre
- Private sector (including clusters and networks)
- Public sector (including operational agencies, coordinating agencies and networks)
- Non-governmental organisation
- Other (please describe)

5. Is your organisation a data provider? *

- Yes
- No

6. Which of the following best describes your position in your organisation? *

- Junior researcher/academic
- Senior researcher/academic
- Company manager
- Engineer/technician (IT, instrumentation, facilities, etc)
- Project manager
- Other - please describe

7. Is your organisation a partner in AtlantOS? *

- Yes
- No

8. Is engaging with stakeholders a relevant part of your duties (i.e., represents more than 20% of your working time)? Please refer to the definitions provided in the Introduction of this questionnaire to answer this question *

- Yes
- No

Part 2: Identifying stakeholders

Page description:
Amongst the range of potential beneficiaries/users of your activities, we would like to know which are the most relevant for you, and which could be most beneficial for AtlantOS.

9. The following stakeholder groups are important users of my work: *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Don't know
Tourism	○	○	○	○	○	○
Marine renewable energy	○	○	○	○	○	○
Aquaculture	○	○	○	○	○	○
Mineral resources	○	○	○	○	○	○
Biotechnology	○	○	○	○	○	○
Maritime transport	○	○	○	○	○	○
Fisheries	○	○	○	○	○	○
Ship building	○	○	○	○	○	○
Offshore oil and gas	○	○	○	○	○	○
Maritime safety	○	○	○	○	○	○
Public sector - local	○	○	○	○	○	○
Public sector - national	○	○	○	○	○	○
Public sector regional/international	○	○	○	○	○	○
Policy makers	○	○	○	○	○	○
Operational agencies	○	○	○	○	○	○
Funding agencies	○	○	○	○	○	○
Scientific community	○	○	○	○	○	○
Civil society - NGOs	○	○	○	○	○	○
Civil society - students	○	○	○	○	○	○
Civil society - general public	○	○	○	○	○	○

10. The following stakeholder groups could be important users of AtlantOS outputs: *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	Don't know
Tourism	○	○	○	○	○	○
Marine renewable energy	○	○	○	○	○	○
Aquaculture	○	○	○	○	○	○
Mineral resources	○	○	○	○	○	○
Biotechnology	○	○	○	○	○	○
Maritime transport	○	○	○	○	○	○
Fisheries	○	○	○	○	○	○
Ship building	○	○	○	○	○	○
Offshore oil and gas	○	○	○	○	○	○
Maritime safety	○	○	○	○	○	○
Public sector - local	○	○	○	○	○	○
Public sector - national	○	○	○	○	○	○
Public sector regional/international	○	○	○	○	○	○
Policy makers	○	○	○	○	○	○
Operational agencies	○	○	○	○	○	○
Funding agencies	○	○	○	○	○	○
Scientific community	○	○	○	○	○	○
Civil society - NGOs	○	○	○	○	○	○
Civil society - students	○	○	○	○	○	○
Civil society - general public	○	○	○	○	○	○

11. Intermediate users are those who can add value to ocean observatory outputs by tailoring them for specific end-uses, e.g. a company using tide gauge data to develop a high resolution traffic model for harbour authorities and operators.

Do you think that intermediate users should be a priority stakeholder for AtlantOS? *

- ○ Yes
- ○ No

Part 3: Why engage with stakeholders?

Page description:
Amongst the range of benefits of engaging with stakeholders, we would like to know which are the most important for your organisation. Don't forget that we are thinking of stakeholders mostly as users of your organisation's outputs

12. My organisation engages with stakeholders for the following reasons (*please use the comments box to indicate any other reasons*): *

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	D k
Gather ideas, strategic insights, suggestion to improve activities	○	○	○	○	○	
Get a higher profile, gain trust and enhance reputation	○	○	○	○	○	
Improve the dissemination and impact of activities	○	○	○	○	○	
Secure support (endorsement/funding/resources)	○	○	○	○	○	
Provide equal rights and access to scientific knowledge	○	○	○	○	○	
Obtain information about users and their needs in order to improve uptake	○	○	○	○	○	
Increase the number of users and customers	○	○	○	○	○	
Sell services to customers	○	○	○	○	○	

Comments

13. Now we would like to know your opinion about why AtlantOS should engage with stakeholders.
(*please use the comments box to add any further reasons*)

AtlantOS should engage with stakeholders to : *

	Strongly disagree	Disagree	Neither disagree or agree	Agree	Strongly agree	Do kn
Gather ideas, strategic insights, suggestion to improve activities	○	○	○	○	○	
Get a higher profile, gain trust and enhance reputation	○	○	○	○	○	
Improve the dissemination and impact of activities	○	○	○	○	○	
Get support: endorsement/funding/resources	○	○	○	○	○	
Provide equal rights and access to scientific knowledge	○	○	○	○	○	
Obtain information about the users and their needs to improve uptake	○	○	○	○	○	
Increase the number of users and customers	○	○	○	○	○	
Ensure that AtlantOS is seen as a as Regional node "best-practice" that could be applied to other Regional nodes	○	○	○	○	○	
Create a more efficient working value chain between ocean data production and end-user services and products to support Blue Economy	○	○	○	○	○	

Comments

Part 4: How best to engage with stakeholders?

Page description:
The number of tools that can be used to engage with stakeholders is broad and their relevance and usage changes constantly. We would like to know how relevant you consider those tools to be, taking into consideration your experience of using them (how often you use them, if you think they are useful or not…).

14. Please rank the following engagement tools according to their relevance to your work (*if you have further suggestions please use the comment box below*):
*

	Not relevant	Fairly relevant	Very relevant	Essential	Don't know
Social Media: facebook, twitter, linkedin…	○	○	○	○	○
Blogs, e-news, newsletters	○	○	○	○	○
Workshops, open days, meetings	○	○	○	○	○
Leaflets, brochures (hard copies)	○	○	○	○	○
Surveys, questionnaires	○	○	○	○	○
e-learning tools: webinars, online tutorials	○	○	○	○	○
Science-Policy briefings	○	○	○	○	○
Door knocks/One-to-one meetings/interviews	○	○	○	○	○
Presentations at conferences, business conventions etc.	○	○	○	○	○

Comments

15. Please rank the following engagement tools according to their relevance to AtlantOS (*please use the comments box below to add any other tools not listed*):
*

	Not relevant	Fairly relevant	Very relevant	Essential	Don't know
Social Media: facebook, twitter, linkedin…	○	○	○	○	○
Blogs, e-news, newsletters	○	○	○	○	○
Workshops, open days, meetings	○	○	○	○	○
Leaflets, brochures (hard copies)	○	○	○	○	○
Surveys, questionnaires	○	○	○	○	○
e-learning tools: webinars, online tutorials	○	○	○	○	○
Science-Policy briefings	○	○	○	○	○
Door knocks/One-to-one meetings/interviews	○	○	○	○	○
Presentations at conferences, business conventions etc.	○	○	○	○	○

Comments

16. We would like to know a little bit more about your preferences. Can you explain to us why you think certain tools are particularly efficient? If you care to share any experience or thought about that with us please, use the box below.

Data portals

Page description:
This final section specifically deals with ocean observatories and their core user-interaction tool, marine data portals. Many of the engagement tools listed in the previous table can be integrated in data portals. Furthermore, data portals are the fundamental interface used by ocean observatories to provide services to their users. We would like to know your opinion about which data portal attributes work best in attracting users.

17. Which attributes make a marine data portal successful? (*if you have additional suggestions please use the comment box below*)
*

	Not relevant	Fairly relevant	Very relevant	Essential	Don't know
Portal layout (appealing interface)	○	○	○	○	○
Ease of use (easy to find your way around to get what you need)	○	○	○	○	○
Data policy (user registration required or not…)	○	○	○	○	○
Data delivery (manual download, WMS, WFS…)	○	○	○	○	○
Pricing (free of charge or not)	○	○	○	○	○
Data readiness (several formats available)	○	○	○	○	○
Reliability (system not failing)	○	○	○	○	○
Data quality - resolution	○	○	○	○	○
Data quality - accuracy	○	○	○	○	○
Data quality - completeness	○	○	○	○	○
Advanced data search/filtering	○	○	○	○	○
In-portal data plotting/mapping	○	○	○	○	○
Metadata availability	○	○	○	○	○
Possibility of interacting (help desk, feedback loop, etc)	○	○	○	○	○

Comments

18. Almost finished! We have one more question to ask.
Before finishing this questionnaire, please name a data portal that you consider is a good example and give a short explanation of why.

Thank You!

Thank you for taking the time to complete our survey.